French Masonry.

The walls are generally built solid, and the method of working and fixing is different to that followed in England. The masons are divided into two classes, first, those that take the rough block as it comes from the quarry, two men generally working together sawing and roughing out, and making beds and joints. The principal tools used are the axe and a kind of drag, formed out of a piece of wood about 8 inches by 3 inches, with six pieces of saw plate inserted. The prepared stones are taken by laborers to the lift, which is in most cases a square fixed scaffold with patent crab at bottom, which can be worked by hand or steam power. These scaffolds are fixed at the commencement of building to the intended height, and are built of timber from 8 to 10 inches square, braced with bolts and dogs. The stones are drawn up to the height required, and are then rolled from the scaffold to the wall, and placed in by means of bars, no other appliances being used. This is certainly no improvement on the English system of fixing. The beds and joints are rough and large, varying from ½ inch to ¾ inch. In fixing and working the men do not regard the position of beds and joints. These often come close to the nose of architraves in the center of pilasters and close to breaks. After the wall is built they start from the top of the structure and work down. The masons who do this part seem to be very good workmen, finishing their work quite as well as English masons. Their tools are similar, excepting that they use planes which are formed to suit any kind of moulding. These tools would not answer for English soft stones, which are more subject to veins and bars.—*W. Pyle.*

Rapidity of Calculation, as Increased by the Avoidance of Repetition, and the Use of Mental Processes instead of Written.*

Increased rapidity may readily be attained in adding, subtracting, multiplying and dividing by simply omitting repetitions and mentally consolidating processes. In adding numbers it is not necessary to use the words "and" and "are," even in thought, and much time will be gained by mentally adding the amounts of pairs or triplets of the sums to be added, writing only the total amount. After some practice it will be found easy to add in in this way sums consisting of two, three or four figures each. In subtraction, increased speed may often be gained by the substitution of addition, particularly when combined with multiplication, to obtain the remainders in long division.

The benefits of the avoidance of repetition, and mental combination of processes, are most evident in multiplication, where time and paper can be economized by not writing the partial products. When squaring numbers, the system has been called "Cross Multiplication," and when the number to be squared contains from eight to twelve, or even more, figures, a little practice will enable one to obtain the result more accurately and rapidly by actual multiplication than by the use of logarithms. The writer first saw this method of squaring numbers, used by Mr. Hutchings (Barnum's Lightning Calculator), about twenty five years ago.

In illustration, all that need be written in the process is as follows, viz.:

7 411 145 224.^{2}=54 925 073 531 218 010 176.

and if the number to be squared contains no decimals, the accuracy of the right hand figures makes this method more valuable than the use of logarithms, besides being practicable when tables of logarithms are not convenient or obtainable. The mental process of the above is as follows:

$4^2=\underline{16}$, $1+2(4\times2)=\underline{17}$; $1+2(4\times2)+2^2=\underline{21}$; $2+2(4\times5)+2(2\times2)=\underline{50}$; $5+2(4\times4)+2(2\times5)+2^2=\underline{61}$; $6+2(4\times1)+2(2\times4)+2(2\times5)=\underline{50}$; $5+2(4\times1)+2(2\times1)+2(2\times4)+5^2=\underline{58}$; $5+2(4\times1)+2(2\times1)+2(2\times1)+2(5\times4)=\underline{61}$; $6+2(4+4)\times2(2\times1)+2(2\times1)+2(5\times1)+4^2=\underline{72}$; $7+2(4\times7)+2(2\times4)+2(2\times1)+2(5\times1)+2(4\times1)=\underline{101}$; $10+2(2\times7)+2(2\times4)+2(5\times1)+2(4\times1)+1^2=\underline{73}$; $7+2(2\times7)+2(5\times4)+2(4\times1)+2(1\times1)=\underline{85}$; $8+2(5\times7)+2(4\times4)+2(1\times1)+1^2=\underline{113}$; $11+2(4\times7)+2(1\times4)+2)(1\times1)=\underline{77}$; $7+2(1\times7)+2(1\times4)+1^2=\underline{30}$; $3+2(1\times7)+2(1\times4)=\underline{25}$; $2+2(1\times7)+4^2=\underline{32}$; $3+2(4\times7)=\underline{59}$; $5+7^2=\underline{54}$; the underscored figures forming the square in inverse order.

Pursuing the ordinary routine, in multiplying dissimilar factors, the same degree of conciseness may be attained; dispensing with the record of the partial products, and making the process more accurate as well as more rapid than by the use of logarithms, after practice has given familiarity with the mode.

275 364. × 362 845. = 99 914 450 580.;

the solution not requiring any other writing than that of the figures and signs above given.

The mental process may be illustrated as follows:

275364	Simple checks against errors are, first; the number of figures in the product; which will be the aggregate of the number in both factors, or one less if the left hand figures of the factors are so small that their product is less than ten after adding what may be carried from those at the right; second: by reason of the peculiar property of the number nine, if either of the factors is an exact multiple of nine, the sum of its figures will be also, and so will be the product. If neither of the factors is an exact multiple of nine, the remainder of the product after casting out the nines, will equal the product of the remainders of the factors.
362845	
20	
30	
16	
48	
15	
24	
32	
75	
25	
12	
48	
8	
100	
35	
20	
24	
12	
24	
125	
10	
28	
40	
6	
36	
12	
144	
8	
56	
10	
18	
18	
124	
16	
14	
30	
9	
81	
4	
42	
15	
69	
12	
21	
39	
6	
9	

In the last given example, the sum of the figures of the multiplicand is 27; consequently the sum of those in the product will be exactly divisible by nine, which is the case with 54.

In the first example, the remainder of the root was 4, the square of which (16) is 7 more than nine, which we find to be the remainder of the product (70).

This check is reliable unless two or more balancing errors are made, which is not likely to be the case after becoming familiar with the method.

(The proof of multiplication by casting out the nines, is very old; the name of the one who first made known its value being unknown to the writer. Attention is here drawn to it, because of its constant use by the writer as a check against errors in obtaining the product of dissimilar factors in the manner above shown.

The method above described for multiplying unlike factors was suggested by Hutchings' system of cross-multiplication for obtaining squares, and the writer had never known it to be used by others than himself until after this was given for publication; when he ascertained that the methods therein described were given in Fairbanks' Commercial Arithmetic, published in 1871.

The writer has used the method continuously since 1861, supposing himself to be alone in its use.)

In division, increased conciseness and rapidity are gained by not recording the partial products or subtrahends, and by the substitution of addition for subtraction; writing the new dividends at the time of multiplying the divisor by each figure of the quotient.

2756432.106 ÷ 2684.245 = 1026.892 $\frac{1332160}{1664475}$

The process being as follows:

```
2684.245)2756432.106(1026.892
          7218710
         18502206
         23967360
          24934000
           7757930
           2389460
```

When using logarithms for multiplying we have no efficient method of proof, and the last one, two or three figures at the right of the product are almost invariably incorrect.* Tables of logarithms are too cumbrous for engineers' field use where the above described methods will be found very valuable in applying the natural trigonometrical functions, and practice may give such facility as to cause logarithms to be discarded for making ordinary engineering calculations in the office.

Tall Chimney Construction.

TAKING DOWN CHIMNEYS.

There is an ingenious arrangement for facilitating the taking down an old chimney-shaft, which was employed, some little time ago at Messrs. Gilkes, Wilson, Pease & Co.'s Iron Works, Middlesborough, and which was designed by the engineer of the works, Mr. Charles Wood. In consequence of the chimney-shaft, on which this arrangement was employed, standing in a crowded position, the plan of letting it fall was inadmissible, and it had to be taken down from the top.

The question was—how to get the bricks down with as little damage as possible, so that they might be used again for building purposes? Owing to the position of the chimney, the bricks could not be thrown down outside; and if thrown down inside, they would be smashed, or if lowered by mechanical means, the process would have been very tedious.

Under these circumstances, the question was considered whether the bricks could not be allowed to fall by their own gravity; but, at the same time be cushioned sufficiently to break their fall and prevent damage. In order to do this, an air-tight iron box was placed at the bottom of the chimney; this box was fitted with an air-tight door, mounted on hinges, and closing on an India-rubber face, against which it was tightened by a wedge.

A wooden spout was then fixed on to the top of the box, and carried up to the top of the chimney; this spout was three-and-a-half inches by five inches inside, and was made of planks one-and-one-eighth inches thick, well nailed together, with a little white lead on the edges, thus making the spout perfectly air-tight. The spout was made in about twelve-foot lengths, and they were formed together

*Read before the Section of Mathematics and Astronomy of the American Association for the Advancement of Science, at Ann Arbor, Mich. 27th Aug. 1885, by Stephen Samuel Haight, C. E. of West Farms, N. Y. City.

*In Bremiker's revision of Vega's Logarithms which tables are used by the writer), the statement is made that in taking out the number corresponding to a given logarithm, "It is inexpedient to take more than eight figures, even the eighth being incertain." As only the eight left hand figures are reliable when using logarithms carried to seven places of decimals, the logarithmic solution of the first example above given, would be erroneous to the extent or hundreds of billions.

by cast-iron sockets or shoes, and caulked round with tarred yarn, the whole apparatus costing about £6.

A few stays were put inside the chimney to keep the spout steady, and steps were nailed upon it by which the men could ascend. It will be seen that the whole of the spouting being perfectly air-tight, if a brick filled the spout perfectly, it would not descend: but, as the section of a brick is three inches by four-and-a-half inches, and the spout was three-and-a-half inches by five inches, there was a half-inch space each way, through which the air could pass the brick freely; this space further allowing for any irregularity in the size of the bricks. The result was that the bricks, being partially cushioned in their fall, arrived at the bottom without any damage whatever. As soon as the box was full, the mate at the bottom rapped on the spout as a signal to stop, and then opened the air-tight door, and removed the bricks which had come down. This being done, he again shut the door, and signalled to the man on the top to go on again. The man on the top lowered his own scaffold, and as the spout got too high, he cut a piece off with a saw. If there was much mortar adhering to the bricks, it was knocked off before putting the latter into the spout, and it was allowed with any little pieces to fall inside the chimney, and was wheeled out.

The plan described is, I believe, quite new, and it is certainly most simple and ingenious. There are, no doubt, many circumstances under which it might be advantageously employed.

PROBABLE CAUSE OF FAILURE IN SOME SHAFTS.

Sulphate-of-Magnesia (Epsom Salts) is largely produced by the decomposition of mortar. In lime, burnt from magnesian limestone, the result is a mixture of lime and magnesia in varying proportions, which when slaked and made into mortar is very susceptible to the influence of sulphurous flames. These re-act, forming the sulphates of lime and magnesia. The great solubility of sulphate-of-magnesia facilitates its diffusion, and makes it the chief cause of defacement, sulphate-of-lime being comparatively insoluble. As the sulphate-of-magnesia dissolves and effloresces, the mortar is disintegrated. Sulphurous acid from coal burnt in houses produces its chief effects before it is diffused in the outer air. As it passes up through a chimney it finds its way through crevices and pores in the wall, and thus directly attacks the mortars, sometimes causing the fall of chimneys by eating out the mortar cementing them.

STRAIGHTENING A CHIMNEY BY PRESSURE.

The foundation of a furnace-shaft in course of erection by M. Dubose, at Havre, had settled very irregularly in consequence of the very unequal resistance of the soil, and so quickly that it was found impossible to complete it. The upper part had consequently to be taken down again, and the completion of the remaining fifteen feet had to be postponed until the chimney had been straightened. This latter operation was effected in the following manner:—The soil on the side opposite the sinking was removed to a breadth of about four-and-a-half feet, and to the depth of the last stage of the foundation. Upon the lowest stage a number of piers leaning against the chimney-shaft were erected to the height of the ground level, and the semi-circular ditch thus formed was covered with radiating double T beams, which were protected against sinking in the soil by a layer of sleepers, and rested on the piers. Planks were then laid on the beams, and about 30,000 bricks were put on them. This one-sided weighting of the foundation had the desired effect of bringing the shaft back to its perpendicular position, the movement within six weeks at the top being nearly one foot, so that a deviation from the perpendicular was then hardly noticeable.

MOVING A CHIMNEY.

In 1872, at the Cabot Mills, Brunswick, Me., a chimney, seven feet nine inches square at the base, and five feet nine inches square at the top, containing upwards of 40,000 bricks, and weighing more than one hundred tons, was moved twenty feet, to make room for the enlargement of the mill, on the plan of Benjamin Greenes. The work was done by a process similar to that by which ships are launched, the chimney being slid along greased planks. It was moved, the flues connected, and the fires started in eight-and-a-half hours. The power used was two screw-jacks.

STANTON, NEAR NOTTINGHAM, IRON WORKS CHIMNEY.

Height 190 feet. Across the cast-iron cap, 24 feet. Weight of cap, 15 tons. Across opening at top, 13 feet 9 inches. Number of bricks used in construction, 420,000.

When finished in March, 1874, fifty persons partook of a hot dinner provided for the occasion on the top of this shaft. Accounts published at the time state that they sang grace, drank the usual loyal and other toasts, concluded with the "National Anthem," and all descended in perfect safety.—*American Architect.*

THE highest chimney yet built in the world has just been completed at the Mechernich Lead-works in Germany. The whole height of the structure is approximately 440 feet, 11 feet of which is under ground. The subterranean portion is of block-stone, 37 feet square in plan, all the rest is of brick. The plinth, or lower part of the chimney above ground, is 34 feet square, so that the height of the shaft is nearly thirteen times the lower diameter. For about 34 feet the chimney continues square; then becomes octagonal in plan for a little distance, and finally changes to a circular form, retaining this shape to the top. The exterior diameter of the shaft at the top is about 11½ feet. The flue is 11½ feet in diameter at the bottom, and 10 feet at the top. Until the completion of this chimney, that of the St. Rollox Chemical Works near Glasgow, which is 434 feet high, enjoyed the honor of being the tallest in the world.

Reports on Methods of Working the Tunnels on the South Pennsylvania Railroad.

The following material is obtained directly from the official reports of the Division Engineers of the South Pennsylvania Railroad. The illustrations and answers to the questions here published are taken from the final returns of this nature, under the dates given on each report. A summation of results will follow.

The diagrams show the method of working, the number and direction of drill-holes and the tunnel section. It should be understood that in the "Transverse Sections" shown, the center-cut of the heading is V-shaped in plan, the holes entering the face at a distance of from six to eight feet apart. The second set of holes in the heading are the "squaring-up" holes; the others are for the top and side enlargement. The tunnel-section generally shown is sixteen feet wide by twenty-one feet center-height. The heading is usually seven feet high, and the benches eleven feet and seven feet above grade.

The schedule of questions which the Division Engineer was required to answer is given below, and the answers themselves are simply referred to their appropriate questions by the number of the latter. To avoid unnecessary repetition we follow a similar method. The question schedule is as follows:

No. 1:—Name of tunnel and end—as "Blue Mt. East?"
No. 2:—Character of material?
No. 3:—Angle of inclination of rock, East or West?
No. 4:—Size of heading as driven?
No. 5:—Number, position and depth of holes for cut?
No. 6:—Pounds and quality of explosives per cut?
No. 7:—Amount of progress in lineal feet of average cut?
No. 8:—Time consumed? (*a*) Drilling cut; (*b*) drilling and firing same; (*c*) getting ready for next cut?
No. 9:—Number, position and depth of holes for side-round?
No. 9½:—Do you drill side-round holes at same time with heading holes?
No. 10:—Pounds and quality of explosives in side-round?
No. 11:—Cost of explosives per lineal foot of tunnel?
No. 12:—Force employed—Heading and bottom separately?
No. 13:—Position of machines for Nos. 5 and 9?
No. 14:—How do you work your bottom?
No. 15:—Yardage, time, force, holes and explosives for bottom?
No. 16:—What style of temporary timber?
No. 17:—What is your greatest difficulty?

NOTE:—All yardages mentioned refer to actual amount of excavation: quantities are based on actual observations by members of the engineer corps, and may be considered as a close approximation.

As closely connected with the better understanding of the material to follow, we give the name, length, etc., of the various tunnels on the South Pennsylvania Railroad and the names of the various contractors from the last official Progress Report, as follows:—

South Pennsylvania R. R.
LENGTH OF TUNNEL DRIVEN, TO OCTOBER 17, 1885.

NAME.	Finished Length.	Heading. W. End.	Heading. E. End.	Bottom. W. End.	Bottom. W. End.	Length Remaining Heading.	Length Remaining Bottom.	Names of Contractors.
No. 1. Blue Mt	4240	1188	1875	1108	1846	1177	1226	Mason, Hoge & Co.
No. 2. Kittatinny	4620	1675	2382	1632	2340	563	648	Evans and Ackerman.
No. 3. Tuscarora	5225	1803	1950	1777	1933	1469	1515	Mason, Gooch, Hoge & Co.
No. 4. Sideling Hill	6662	1677	1699	1682	1685	3386	3415	O'Brien & Rodgers.
No. 5. Rays Hill	3834	1178	1317	1153	1334	1039	1047	McMahon, Shanahan & Green.
No. 6. Allegheny Mt.	5919	1913	2033	1780	1721	1973	2418	Charles McFadden.
No. 7. Negro Mt.	1100	45	660		647	366	453	Patterson & Kuhn.
No. 8. Quemahoning	700	339	73	313		288	387	John McGovern.
No. 9. Laurel Hill	5389	889	396	848	110	4104	4431	P. & T. Collins.
Totals	37,389					14,365	15,540	

TO BE CONTINUED.

No. 1.—BLUE MOUNTAIN TUNNEL.

1. Blue. Mt., West.

2. Olive shale of Clinton formation; slightly decomposed along bedding and joint surfaces. Occasional mud seams, varying in thickness from ¼ of an inch to three inches are met with. No sandy streaks.
3. 69° west.
4. See sketch.—Yardage, 3.7 cubic yards per lineal foot.
5. Number and position generally as shown on sketch. Depth of Center Cut holes 9.7 feet and at Squaring Up holes 9.8 feet.
6. Center Cut, 1st loading 62 pounds + 2nd and 3d loading 16 pounds = 78 pounds.
   Squaring Up 1st loading 43 pounds + 2nd and 3d loading 4 pounds = 47 pounds.
   Dynamite 78 pounds 40%, and 47 pounds 35%.
7. 7.6 feet.
8. 19 hours 43 minutes, (a) 13 h. 45m. (b) 58 m. (loading whole cut 30 m. Firing 28 m. (c) 5 h.
9. For number and position, see sketch. For top and side enlargement 5.0 feet of holes per lineal foot of tunnel. Yardage, 3 cubic yards per lineal foot.
9½. Yes. Top and side enlargement is made by a force independent of heading force.
10. Top 0.50 pounds, 40% dynamite, and side 3.0 pounds 40% dynamite per lineal foot of tunnel.
11. Advance heading, 10.26 pounds 40% dynamite, and 6.18 pounds, 35% dynamite per lineal foot.
    Top and side enlargement, 3.50 pounds, 40% dynamite per lineal foot. Bench.
12. Force per lineal foot of tunnel.

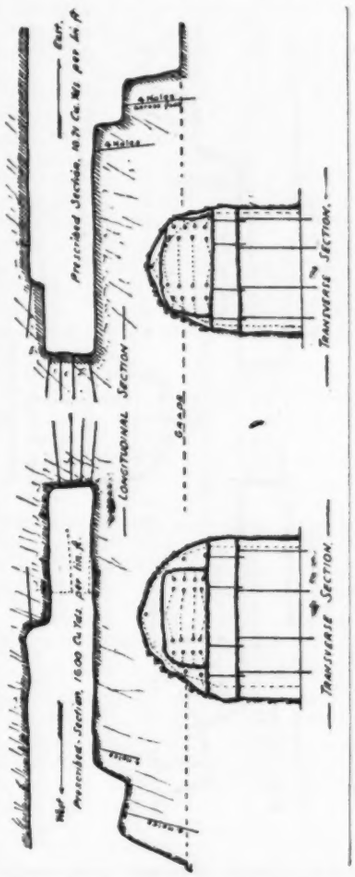
	HEADING.		BENCH.	
Foreman	0.26	Days	0.32	Days.
Power Drillers	0.71	"	0.58	"
" Helpers	0.71	"	0.58	"
Muckers	1.69	"	3.04	"
Trimmers	0.20	"		
Nippers	0.26	"	0.24	"

13. See sketch. Columns in heading about 3 feet from face.
14. See sketch. A small portion of material from upper lift of bench is wheeled by plank bridges to a portable platform and dumped into cars at grade; balance loaded from grade.
15. Yardage, 12.4 cubic yards per lineal foot. Time, 3h. 11m. per lineal foot. Holes 12 feet per lineal foot. Explosives, 7 pounds 35% dynamite per lineal foot.
16. None used.
17. Loading bench muck into cars.

Force (per 10 hour shift) not accounted for above.

General Foremen	0.50	Drivers	3.50
Engineers	1.00	Blacksmiths	0.75
Firemen	—	" Helpers	0.50
Horses	3.50	Dumpmen	1.00

The above derived from notes taken between April 17th and 25th, 1885.



1. Blue Mt. East

2. Red Medina Sandstone. Hard and fine grained.
3. 79° West.
4. See sketch. Yardage, 2.8 cubic yards per lineal foot.
5. Number and position generally as shown on sketch. Depth of Center Cut holes 6.5 feet and of Squaring Up holes 7.3 feet.
6. Center Cut, 1st loading 45 pounds + 2nd and 3rd loading 27 pounds = 72 pounds.
   Squaring Up, 1st loading 45 pounds + 2nd and 3rd loading 5 pounds = 50 pounds.
   Dynamite, 61 pounds 40% and 61 pounds 60%.
7. 5.2 feet.
8. 27 hours. (a) 22h. 35m. (b) 1h. 30m. (Loading Center Cut holes 15m.—loading Squaring Up holes 10m.—Firing 1h. 05m. (c) 2h. 55m.
9. For number and position see sketch. Side hole only occasionally used. For top and side enlargement, 2 feet of holes per lineal foot of tunnel. Yardage, 1.8 cubic yards per lineal foot.
9½. Yes. Top and side enlargement is made by a force independent of heading force.
10. Top 0.84 40% dynamite, and side 1 pound 40% dynamite per lineal foot of tunnel.
11. Advance heading, 11.73 pounds 60% dynamite, and 11.73 pounds 40% dynamite per lineal foot.
    Top and side enlargement, 1.84 pounds 40% dynamite per lineal foot.
    Bench, 15 pounds 40% dynamite, and 1.5 pounds 60% dynamite per lineal foot.
12. Force per lineal foot of tunnel.

	HEADING.		BENCH.	
Foremen	0.56	Days.	0.50	Day
Power Drillers	1.67	"	1.20	"
" Helpers	1.67	"	1.20	"
Muckers	1.46	"	4.40	"
Trimmers	0.19	"		
Nippers	0.56	"	0.50	"

13. See sketch. Columns in heading about 3 feet from face.
14. See sketch. A small portion of material from upper lift of bench is wheeled by plank bridges to a portable platform and dumped directly into cars at grade;—balance loaded from grade.
15. Yardage, 8.2 cubic yards per lineal foot. Time per lineal foot 5h. 12m.
    Holes, 22.1 feet per lineal foot. Explosives 15 ponnds 40% dynamite per lineal foot and 1.5 pounds 60% dynamite per lineal foot.
16. None used.
17. Lack of Drilling Power.

Force (per 10 hour shift) not accounted for above.

General Foremen	0.50	Drivers	3.50
Engineers	0.70	Blacksmiths	1.50
Firemen	0.70	" Helpers	1.00
Horses	3.50	Dumpmen	1.50

The above derived from notes taken between March 25th and April 8th, 1885.

No. 2.—KITTATINNY TUNNEL.

1. Kittatinny, West.

2. Red Medina Sandstone. Hard and fine grained.
3. 86° East.
4. See sketch. Yardage—3.3 cubic yards per lineal foot.
5. Number and position generally as shown on sketch. Depth of Center Cut holes 3.3 feet and of Squaring-up holes 3.0 feet
6. Center Cut, 1st loading 63 pounds + 2nd and 3rd loading, 49 pounds = 112 pounds.
   Squaring Up, 1st loading 54 pounds + 2nd and 3rd loading 5 pounds = 59 pounds.
   Dynamite—149 pounds 60% and 22 pounds 40%.
7. 5.1 feet.
8. 25 hours. (a) 21h. 20m. (b) 1h. 20m. (Loading Center Cut holes 15m.—loading Squaring-Up holes 10m. Firing 55m. (c) 2h. 20m.
9. For number and position, see sketch. For top and side enlargement, 4 feet of holes per lineal foot of tunnel. Yardage 1.1 cubic yards per lineal foot.
9½. Yes. Top and side enlargement is made by a force independent of heading force.
10. Top, 0.67 pounds, 60° dynamite, and side 2 pounds, 60% dynamite per lineal foot of tunnel.
11. Advance heading 29.2 pounds 60% dynamite, and 43.1 pounds 40% dynamite per lineal foot.
    Top and side enlargement of heading, 2.67 pounds 60% dynamite per lineal foot.
    Bench, 17 pounds 60% dynamite per lineal foot.
12. Force per lineal foot of tunnel.

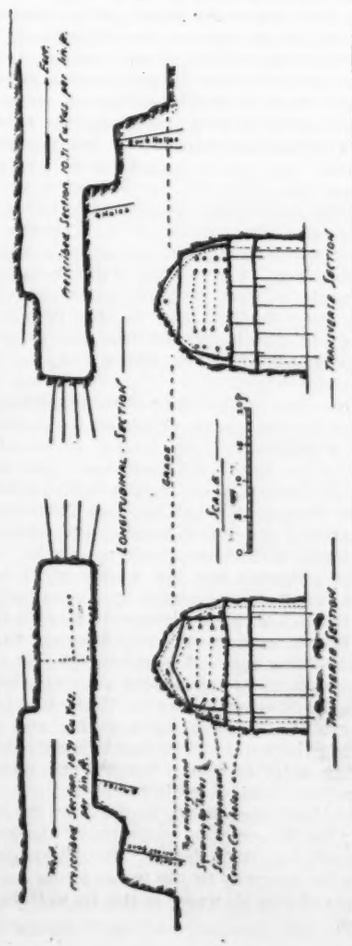
	HEADING.		BENCH.	
Foremen	0.53	Days	0.60	Days.
Power Drillers	1.39	"	1.00	"
" Helpers	1.39	"	1.00	"
Muckers	2.35	"	4.30	"
Trimmers	0.96	"		
Nippers	0.53	"	0.50	"

13. See sketch.—Columns in heading about 3 feet from face.
14. See sketch.—A small portion of material from upper lift of bench is wheeled by plank bridges to a portable platform and dumped directly into cars at grade, balance loaded from grade.
15. Yardage, 8.6 cubic yards per lineal foot. Time per lineal foot 4h. 44m.
    Holes, 16.2 feet per lineal foot. Explosives, 17 pounds 60% dynamite per lineal foot.
16. None used.
17. Lack of Drilling Powder.

Force (per 10 hours shift) not accounted for above.

General Foremen,	0.50	Drivers,	3.10
Engineers,	0.60	Blacksmiths,	2.00
Firemen,	0.60	" Helpers,	2.00
Horses,	3.10	Dumpmen,	1 50

The above derived from notes taken between March 26th April 8th, 1885.



1. Kittatinny, East.

2. Olive Shales of Clinton formation. Compact. No sandy streaks.
3. 20° East.
4. See sketch. Yardage—2.5 cubic yards per lineal foot.
5. Number and position generally as shown on sketch. Depth of Center Cut holes 8.3 feet and of Squaring Up holes 8.1 feet.
6. Center Cut, 1st loading 60 pounds + 2nd and 3rd loading 40 pounds = 100 pounds.
   Squaring Up, 1st loading 58 pounds + 2nd and 3rd loading 6 pounds = 64 pounds.
   Dynamite—164 pounds 35%.
7. 7.3 feet.
8. 19 hours. (a) 12h. 35m. (b) 2h. 05m. (Loading Center Cut holes 20m.—loading Squaring Up holes 15m. Firing 1h. 30 m.) (c) 4h. 20m.
9. For number and position, see sketch. Side hole only occasionally used. 1.5 feet of holes per lineal foot of tunnel. Yardage—1.7 cubic yards per lineal foot.
9½. Yes. Top and size enlargement is made by a force independent of heading force.
10. Top, 0.87 pounds 35% dynamite, and side 0.50 pounds 35% dynamite per lineal foot of tunnel.
11. Advance heading 22.46 pounds 35% dynamite per lineal foot.
    Top and side enlargement, 1.37 pounds 35% dynamite.
    Bench. 15.3 pounds 35% dynamite per lineal foot.
12. Force per lineal foot of tunnel.

	HEADING.		BENCH.	
Foremen	0.26	Days.	0.24	Days.
Power Drillers	0.58	"	0.68	"
" Helpers	0.58	"	0.68	"
Muckers	1.56	"	3.04	"
Trimmers	0.22			
Nippers	0.26	"	0.24	"

13. See sketch. Columns in heading about 3 feet from face.
14. See sketch. A small portion of material from upper lift of bench is wheeled by plank bridges to a portable platform and dumped directly into cars at grade, balance loaded from grade.
15. Yardage, 8.8 cubic yards per lineal foot. Time per lineal foot 2h. 37m.
    Holes, 16.3 feet per lineal foot. Explosives, 15.3 pounds 35% dynamite per lineal foot.
16. None used.
17. Loading bench muck into cars.

Force (per 10 hour shift) not accounted for above.

General Foreman	0.50	Drivers	2.90
Engineers	0.40	Blacksmith's	1.00
Firemen	0.40	" Helpers	1.00
Horses	2.90	Dumpmen	2.00

The above derived from notes taken between March 26th and April 7th, 1885.

No. 3.—TUSCARORA TUNNEL.

1. Tuscarora, East.

2. Black shale of Hudson River formation, with occasional sandy strata.—Rock very seamy and brittle.
3. 65° West.
4. See sketch. Yardage, 3.58 per lineal foot.
5. Number and position generally as shown on sketch. Depth of Center Cut holes 7 feet, and of Squaring Up holes 7 feet.
6. Center Cut, 1st loading, 27 pounds + 2nd and 3rd loading, 6 pounds = 33 pounds.
   Squaring Up, 1st loading 26 pounds + 2nd and 3rd loading 4 pounds = 30 pounds.
   Dynamite 63 pounds 40 %.
7. 4.0 feet.
8. 11 hours. (*a*) 7 h. (*b*) 1 h. (*c*) 3 h.
9. For number and position, see sketch. For top and side enlargement, 4.8 feet per lineal foot of tunnel. Yardage, 0.50 cubic yards per lineal foot.
9½. Yes. Top and side enlargement is made by a force independent of heading force.
10. Top, 0.5 pounds 40 % dynamite, and side 1.9 pounds 40 % dynamite per lineal foot of tunnel.
11. Advance heading 15.75 pounds 40 % dynamite per lineal foot. Top and side enlargement 2.4 pounds 40 % dynamite per lineal foot.
    Bench, 11.43 pounds 40% dynamite per lineal foot.
12. Force per lineal foot of tunnel.

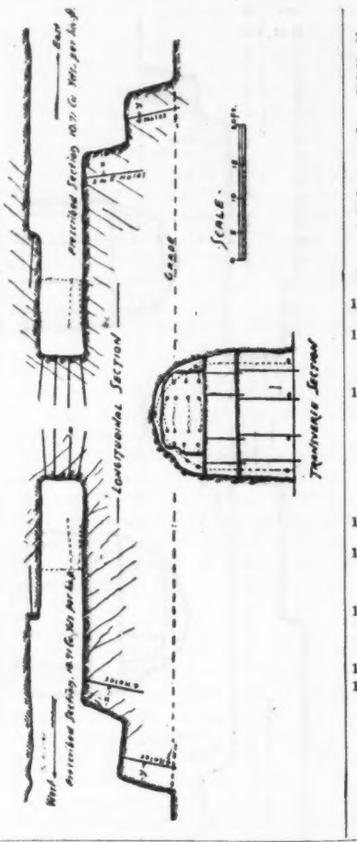
	HEADING.	BENCH.
Foremen	0.25 days.	0.29 days.
Power Drillers	0.69 "	0.57 "
" Helpers	0.69 "	0.57 "
Muckers	1.25 "	2.57 "
Trimmers	0.10 "	
Nippers	0.13 "	0.14 "

13. See sketch. Columns in heading about 3 feet from face.
14. See sketch. A small portion of material from upper lift of bench is wheeled by plank bridges to a portable platform and dumped directly into cars at grade;—balance loaded from grade.
15. Yardage 9.1 cubic yards per lineal foot. Time per lineal foot 2 h. 51 m. Holes 14 to 18 feet per lineal foot. Explosives 11.43 pounds 40 % dynamite per lineal foot.
16. None used.
17. Lack of drilling power.

Force (per 10 hour shift) not accounted for above.

Superintendents	1.00	Blacksmiths' Helpers	0.50
Engineers	1.00	Dumpmen	1.00
Firemen	1.00	Horses	3.70
Blacksmiths	1.00	Drivers	3.70

The above derived from notes taken between March 26th and April 21, 1885.



1. Tuscarora West.

2. Blue Lime Shale of Clinton, formation, with numerous sandy streaks.
3. 60° East.
4. See sketch. Yardage, 3.58 cubic yards per lineal foot.
5. Number and position generally as shown on sketch. Depth of Center Cut holes 7 feet and of Squaring Up holes, 7 feet.
6. Center Cut, 1st loading 26 pounds + 2nd and 3rd loading 11 pounds = 37 pounds.
   Squaring Up, 1st loading 25 pounds + 2nd and 3rd loading 6 pounds = 31 pounds.
   Dynamite, 68 pounds 40 %.
7. 4.0 feet.
8. 11 hours. (*a*) 7 h. (*b*) 1 h. (*c*) 3 h.
9. For number and position, see sketch. For top and side enlargement 3.75 feet of holes per lineal foot of tunnel. Yardage, 0.5 cubic yards per lineal foot.
9½. Yes. Top and side enlargement is made by a force independent of heading force.
10. Top, 0.5 pounds, 40 % dynamite, and side 1.3 pounds, 40 % dynamite per lineal foot of tunnel.
11. Advance heading 17 pounds 40 % dynamite per lineal foot. Top and side enlargement 1.8 pounds, 40 % dynamite per lineal foot. Bench, 16.3 pounds 40 % dynamite per lineal foot.
12. Force per lineal foot of tunnel.

	HEADING.	BENCH.
Foremen	0.25 days.	0.29 days.
Power Drillers	0.83 "	0.58 "
" Helpers	0.83 "	0.58 "
Muckers	1.38 "	2.71 "
Trimmers	0.10 "	
Nippers	0.25 "	0.29 "

13. See sketch. Columns in heading about 3 feet from face.
14. See sketch. A small portion of material from upper lift of bench is wheeled by plank bridges to a portable platform and dumped directly into cars at grade;—balance loaded from grade.
15. Yardage 9.1 cubic yards per lineal foot. Time per lineal foot 2 h. 51 m. Holes, 16 to 20 feet per lineal foot. Explosives 16.3 pounds 40 % dynamite per lineal foot.
16. None used.
17. Lack of drilling power.

Force (per 10 hour shift) not accounted for above.

Superintendents	1.00	Blacksmiths' Helpers	1.00
Engineers	1.00	Dumpmen	1.00
Firemen	1.00	Horses	5.40
Blacksmiths	1.00	Drivers	5.40

General Foremen 0.50.

The above derived from notes taken between March 26th and April 9, 1885.

The Water Supply of Venice.

On the 22nd of June, 1884, the aqueduct constructed by the Compagnie Générale des Eaux of Paris was inaugurated in the presence of the principal authorities, the representatives of the company, and a vast concourse of spectators. A fountain was temporarily constructed on that occasion in the middle of St. Mark's Square, through which the water rose about eighteen metres. It has always been very difficult for Venice to obtain a sufficient supply of potable water, owing to its being founded among the lagoons upon small islands, the subsoil of which appears to be deprived of streams of sweet water. Rain water had been the only source to which recourse had always been had for supplying the inhabitants with water for drinking. Very ingenious reservoirs were constructed, which improved in course of time by use and experience, and exist nowadays and are known under the name of "Cisterne Vineziane." About the sixteenth century, when Venice reckoned a population nearly double its present one, the Senate ordered the opening of a canal named "la Seriola Veneta," for the conveyance of drinkable water from the River Brenta, at Dolo, to the extreme border of the mainland called the "Moranzani," to be then discharged through conduits into the lagoons. Large open barges were sent to this point from Venice to receive the water, which was then brought back to town, and poured by buckets in the conduits leading to the basins of the wells. At the source of the Seriola was set up a marble tablet, which is still extant, bearing the inscription "Hinc urbis potus." The insufficient quantity of water which could thus be obtained, the expenditure incurred in conveying it from the mainland to Venice, and the corruption of its hygienic qualities, which this system of transport invariably occasioned, in addition to the deterioration of the wells by the filtration of salt water in cases of floods or extraordinary high tides, and the heavy amount to be paid for their restoration, made the construction of proper water-works for the regular supply of potable water to the town, an absolute necessity. Since 1866, when Venice was annexed to Italy, divers projects were laid before the Municipality, but owing to technical and economical difficulties, nearly ten years elapsed before any definite decision could be arrived at. It was only on January 25, 1876, that the Municipal Council voted the construction of an aqueduct for the conveyance of potable water from the Seriola to Venice. Among the numerous tenders, preference was given to that presented by two English gentlemen, Messrs. Ritterbandt and Dalgairns, who undertook to construct the water-works and to sink an artesian well 300 metres deep. A concession was subsequently granted to them for sixty years, which in 1879 they handed over to the Compagnie Générale des Eaux. In 1881 the company commenced the works, which were brought to an end in 1884.

According to the terms of the contract between the Compagnie Générale des Eaux and the Municipality, the former is bound to convey to Venice not less than 5,200 cubic metres of water a day—equivalent to about 40 litres of water an inhabitant per diem. Such quantity is of course to be increased whenever the wants of the town should require it.

The following are the works which have been executed:—(*a*) conduit and canal adjoining through which the water is conveyed from the Brenta to the Seriola; (*b*) filtering basins and building annexed containing pumps, etc.; (*c*) conduit under the lagoons conveying water from the filtering basins to Venice; (*d*) large reservoir in the town for receiving and preserving the water; (*e*) hydraulic machines for raising water to upper floors of the houses; (*f*) underground tubing in the town.

The total expenditure incurred by the company for the complete execution of the works amounts to 5,000,000 francs. The Municipality pays the company 100,000 francs a year for the supply of potable water to the 120 wells in the town.

Report of the Chief of Ordnance.

The report of Brigadier General S. V. Benet Chief of Ordnance, U. S. Army, has been submitted to the Secretary of War. The fiscal resources and expenditures of the Ordnance Department during the year are as follows: Resources $2,728,455.84; expenditures, $2,195,761.92; leaving in the Treasury to the credit of appropriations on June 30, 1885, $532,693.92.

In regard to the United States testing machine, General Benet recommends that a smaller machine be obtained wherewith to perform the tests of small specimens.

Concerning the armament of fortifications the report states that the progress in the manufacture of experimental cannon has been so much retarded in the past year that up to the date of this report only the 12-inch m. l. rifled mortar and the 12-inch b. l. rifle cast-iron have been received at the proving ground. The mortar has been fired forty-four times for the purpose of arriving at definite conclusions concerning the forms of the sabot and the natures of powder that appear suitable for the test of the piece. Nothing was determined as to accuracy of fire in these preliminary trials.

The 12-inch cast-iron breech-loading rifle was fired twenty-five times, and the results were sufficient to determine the character of the band to be used with the projectile. The experiments will not, however, be completed until the proper powder can be supplied.

It is, therefore, premature to pronounce the gun a success. An interesting comparison is given between the work of this gun and a Krupp 36.5 centimetre steel breech-loading rifle. Another comparison is made with the 10-inch b. l. rifle, steel, of thirty-two calibres length of bore, weighing about twenty-seven tons. The estimated results are so much in favor of the 10-inch rifle that the report discusses the advisability of Congress making an appropriation for 100 of the 10-inch steel rifles.

The Midvale Steel Company has the contract for a tube, jacket and forged trunnion hoop for an 8-inch gun. These are the largest

forgings yet attempted in this country. The lowest bids for furnishing hoops for the 10-inch steel gun came from the Cambria Iron Company, Johnstown. Pa.

During the year Messrs. Dupont have completed their large press for the manufacture of prismatic powder, and the results obtained from experiments with it have been very satisfactory. A number of devices involving the use of high explosives have been tested, and, instead of the ordinary explosive gelatine, the Ordnance Board have demonstrated that in the future a camphorated variety less sensitive and more uniform in its action should be used.

The 3.2-inch steel breech-loading field gun has been thoroughly tested, having been fired 1,800 rounds in all with satisfactory results, The Board of Ordnance, therefore, recommends that this gun or its modification, which is a slightly heavier model, is a suitable one to be used in Government service. The piece has shown a satisfactory endurance. extent of range and accuracy of fire, while the working of the breech mechanism has been almost unexceptionable.

The Measurement of Velocity in Ocean Currents at Great Depths by the Hydrometic-Wheel.

BY E. SUCHIER, OF WILHELMSHAFEN.

Translated for ENGINEERING NEWS by Geo. J. Specht, C. E.

The Apparatus. The vertical rod for measuring wheels is practical to a depth of 16 to 20 feet. Longer rods used for greater depths, are inconvenient to handle, and cannot be used at depths greater than 33 feet. After that it is better to suspend the apparatus on a wire rope; but as this prevents the guiding of the apparatus, it is necessary to attach a heavy weight under the mechanism, to prevent drift in the comparatively light instrument.

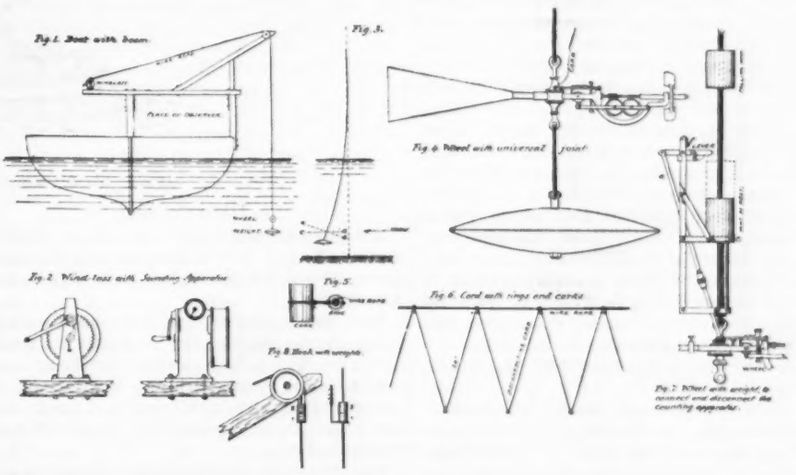
The writer, in the summer of 1884, in measuring velocities in the Jade used a wire rope, made of five wires of 5 m.m. diameter, and an additional weight. This rope was run over a roller at the end of a boom, to the winding apparatus in the boat. (See Fig. 1.) The entire apparatus weighed 99 pounds, and could be easily lifted by one man. A counting device was attached to the windlass, being connected with the drum by gearing. The length of the wire rope run off is directly recorded by it in metres; each revolution of the drum corresponded to one-half metre of the rope, and the counter read to centimetres. (Fig. 2.) As soon as the shaft of the hydrometic-wheel touched the water level, the hand of the counting apparatus was set at zero, and secured by a clamp-screw. In this way the position of the wheel can at any time be known, the apparatus at once giving the depth of the sounding. The man at the crank of the windlass can feel when the weight touches the bottom of the sea, and separate soundings are thus unnecessary.

In heavy currents and great depths, the hydrometric-wheel is always driven from the perpendicular (Fig. 3), and precautions must be taken to prevent the shaft of wheel from assuming an inclined position, as at *a b*. Fig. 4 shows the automatic arrangement for preserving the horizontal position *c d.*; a universal joint is enclosed in the wheel-box, which enables the rudder to set the wheel rapidly and surely in the direction of the current.

The Measurements. The writer used an Amsler-Laffen hydrometric-wheel, with the above-mentioned alterations or additions, in measuring the ebb and flow currents in the Jade, in the second entrance to the harbor of Wilhelmshafen (then under construction), in a maximum depth of 56 feet of water. The measurements were made from an anchored scow.

An electric bell was tried as follows: The battery and the bell were enclosed in a box set in the boat, and they were connected by insulated copper wires with the counting apparatus of the wheel under the water. A spring-lever was attached to the counter, and a pin fastened to the geared wheel in such manner, that as soon as the hydrometic-wheel had made 100 revolutions, this pin touched the spring-lever and caused the bell to ring. The time occupied in making this number of revolutions must be observed.

The advantage of this arrangement was that the wheel remained constantly under water; but this advantage was attended by several disadvantages. For instance, measurement is impossible when the wheel sinks into soft



material, or when sand, etc., settles in the mechanism. The readings also often become very irregular from sea-weed entangling the wheel. Consequently the apparatus should not remain too long under water without being inspected. The great conductivity of the salt water is another great disadvantage. The electric signal apparatus works very well in the open air or in fresh water; but as soon as this is immersed in sea-water the circuit is closed even without the aid of mechanical contact. For this reason the electric bell is useless in sea-water.

A cord was then tried for disconnecting the counting apparatus. A freely suspended cord has many disadvantages; in depths not exceeding 15 feet it works quite well, but in greater depths it cannot be used. The cord can be held too tight when the apparatus is lowered, and thus disconnect the counter too soon; or, if held too loosely the current by its pull on the cord will set off the counting mechanism. Different cords have been tried; spun hemp absorbed too much water and was useless; thin silken cords were torn, after but slight use, and wire also was found impracticable. Spun cotton thread was found to be the best, as it was light and thin, but strong, and did not have a tendency to twist; if the cord twisted but once about the wire rope, the friction would be sufficient to tear it, on being pulled. Great care must be taken so that the wheel does not revolve while it is being lowered. To prevent this an additional cord, about 7 feet long, is fastened to the end of the rudder, by which the wheel is held in the direction of the current, and let down in it. This method gave fair results, but it was not altogether satisfactory. Improvements and experiments were made until finally the following method was adopted:—

When oiled spun cotton thread was used, at every 1½ feet a brass ring, ¾-inch in diameter, was fastened to it; a cork was tied to each second ring (Fig. 5), and the rings were then strung upon the wire rope, as shown in Fig. 6. The alternate rings had no corks and only served for gathering up the cord, when taken up, in such manner that no entanglement ensued. This arrangement of the cord had many advantages; the cord could not drift away from the wire-rope, and the sounding apparatus cannot be connected or disconnected accidentally; the cord cannot twist itself around the wire-rope so as to render the connection with sounding apparatus uncertain, and the cord remains uniformly tight during the lowering of the instrument.

The measurements made, in connection with this improved cord, were very satisfactory. One observer and four well trained assistants were in the scow and one man remained ashore to observe the tide-gauge every fifteen minutes. The management of the cord consumed most of the time, and the writer was continually attempting to devise some plan by which it might be entirely dispensed with.

A falling weight finally suggested itself as a means of connecting and disconnecting the counter on the wheel, and after many trials the construction shown in Fig. 7 was designed by the writer, adopted and proved reliable. The principle of this device is to use a falling weight for the same purpose as the cord. The upper end of a short rod *a*, Fig. 7, which can be lengthened or shortened, connects with a lever *d* on a frame-work attachment. At the upper end of the boom for the wire-rope are two cylindrical weights, of 1.1 pounds each, supported upon a bracket-hook (Fig. 8); these weights are centrally pierced so that they slide freely on the wire-rope. To connect the counting apparatus, one weight is first dropped, it strikes the end of the lever *d*, depresses it and then falls to the plate *c*, where it rests. This depression of the lever *d* starts the counter, but the rod *a* and the lever *d* are at once forced back into position by springs attached to the counting device. At the end of the observation the second weight is let fall and disconnects the counter. The apparatus is then raised, the dials read, the weights put back upon their bracket and the wheel let down for a new measurement.

This device worked well, and the measurements were simple and easily made. The link on the lever *d* permits the weights to be moved upwards when being replaced.

REPORT OF THE GEOLOGICAL SURVEY.—WASHINGTON, Nov. 4th.—The sixth annual report of Professor J. W. Powell, director of the geological survey, covering the operations of the institution for the fiscal year ended June 30, 1885, has been given out for publication. Professor Powell says that during the fiscal year fair progress was made in the topographic survey of the United States. An area of 57,408 square miles was surveyed, and the maps thereof made ready for the engraver. The average cost of the work was about $3 per square mile.

NEW ORDNANCE MATERIAL.*

Official Report to the U. S. War Department.

BY WM. H BIXBY, CAPT. OF ENG'S., U. S. ARMY.

(*Continued from page 293.*)

Gruson's Non-Recoiling Minimum-Embrasure Gun-Cupola Gun.†

Following in the same line of construction as that just described (the Krupp gun-casemate gun) where the recoil is transmitted directly to the iron casemate without the intervention of any hydraulic buffer, Mr. Gruson proposed later a non-recoiling gun-carriage which should be adaptable to his chilled-iron cupolas, their movable trunnion-bed carriages, and their minimum-embrasures.

In this arrangement the trunnion-beds slide vertically in a fixed guide-cylinder braced to the inside of the iron cupola; the gun has a slight forward and back motion through the embrasure, and pivots about this embrasure, either by means of the usual pivoting-guide-bar (described further on under "Gruson muzzle-pivoting gun" C-1880), or by actual contact of the throat of the embrasure against the chase of the gun. The trunnion-beds and gun are moreover supported on a central hydraulic press on which it rotates; the cupola, gun and all, is raised bodily an inch or so (like the turrets of the Ericsson monitors) during traversing of the gun, but it must be lowered before firing in order to give the cupola a firm bearing against the surrounding iron glacis within which it fits accurately.

This mounting was patented by Mr. Gruson in 1883.

Krupp's Non-recoiling Trunnion-pivoted Gun.—The favorable results obtained with the non-recoiling muzzle-pivoted gun led Mr. Krupp in about 1879 to apply the same principle to a trunnion-pivoted gun for use on ship-board or on land. In this arrangement of gun and carriage, the mounting of the gun with respect to its foundations is almost the same as that of the telescope of a surveyor's theodolite with respect to its tripod. The gun's upper carriage carries its own center-pintle which rotates within bearings that are rigidly attached to the ship's frame at sea, or heavy foundations on land. At sea the whole ship acts as an enormous gun-carriage, with the ocean as a correspondingly large hydraulic buffer.

No guns and carriages have so far been constructed upon this system except for small 3.4-inch (8.7-c.m.) guns (1). Mr. Krupp however has proposed this system for use even for the largest guns (2).

Gun-carriages Allowing but Slight Recoil.

Krupp's Slight-recoil Trunnion-pivoted Guns.—Mr. Krupp also proposed in 1881 a slight-recoil trunnion-pivoted gun on a fixed center-pintle carriage which differs from the last described gun and carriage mainly in the introduction of annular disc springs to take up a portion of the recoil.

The center-pintle is of massive construction and is attached rigidly to the ship's deck or to other foundations; the carriage consists principally of two massive trunnion-beds firmly braced together; the gun-trunnions are attached to a trunnion ring which is independent of the gun, and through which the gun slides freely; in front and in rear of the gun are annular disc-springs which press on one side against the trunnion-ring and on the other side against shoulders on both the chase and breech of the gun.

No guns and carriages have so far been constructed upon this system, except for the 3.2-inch (8.0-c.m.) guns for the armament of gun-boats (3). This mounting, using rubber springs, was used successfully for a 10-inch gun in 1862 by E. A. Stevens of Hoboken (see page 591 and 593, Holley Ordnance and Gunnery, New York and London, 1865.

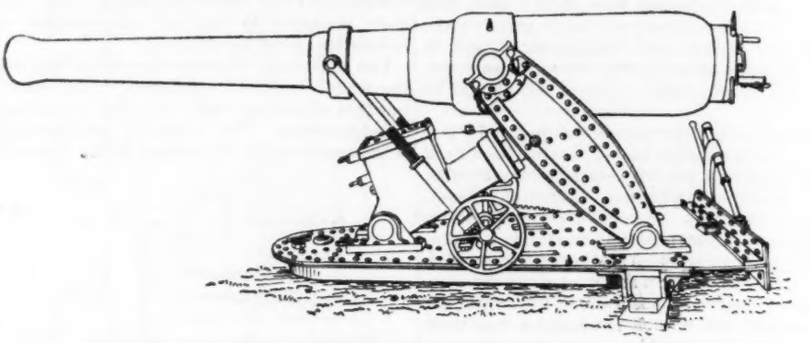


Plate No. 5.—Armstrong-Albini Carriage.

Albini Carriage.

This form of mounting is due to Capt. Albini, Italian Navy. It is at present manufactured in considerable numbers by both Krupp and Armstrong.

The *Krupp Models* are sometimes termed "link carriages" and are generally for small guns. (3). The Krupp carriage for the 8.7-c.m. (3.4-inch) gun when firing a 10 kilogram (22 pounder) shell with 3.5. kilograms (7.7 pounder) cartridge, allows a recoil of from 16 to 24 c.m. (6 to 10 inches).

The *Armstrong Models* (4) are already in use in the British Navy for guns of 40-pounder 4.7-inch (12-c.m.) and 6-inch (15-c.m.) calibers. This form of mounting is fully shown by the annexed illustration (Plate 5). These guns cost complete, with racers, racks, pivots, etc., about $20,000 for the 40-pounders and about $30,000 for the 6-inch guns. The Elswick works do not advise the use of this particular mounting for guns of larger caliber than the 6-inch, because the recoil might be severe enough to tear the platform from the ship-deck or foundation. The Elswick works have however a newer design for non-recoil guns (not yet made public) which they state can be particularly applied to large guns of any weight or power.

Yoke-mountings for 43-ton Guns on Ordinary Carriages (see Plate 6).

The writer had the opportunity of examining, at Shoeburyness, in 1882, the new "yoke" method of checking the recoil of long, heavy, breech-loading guns mounted on the ordinary forms of casemate carriages. This method is due to Colonel Inglis, R. E., and can be applied to almost any carriage providing that the casemate floor and roof will allow of suitable construction to receive it. Its essential feature is the arrangement by which the recoil is transmitted from the gun to the casemate walls without using the chassis rails as an intermediary, thus relieving the chassis rails and platform of all pressures except those uniform pressures due to the mere weight of the gun and carriage, and allowing the gun and carriage to move to the rear smoothly and uniformly. The way in which the recoil is transmitted from the gun to the casemate foundations, is as follows: Two hydraulic buffers are attached at their rear end to the cheeks of the upper carriage just below the trunnion-beds; they are attached at their front end to the middle of two vertical girder posts, one on each side of the gun's chase; these posts are connected together at their top and bottom by two horizontal girders bent into the form of two equal and parallel circular arcs; the centers of these arcs are on the

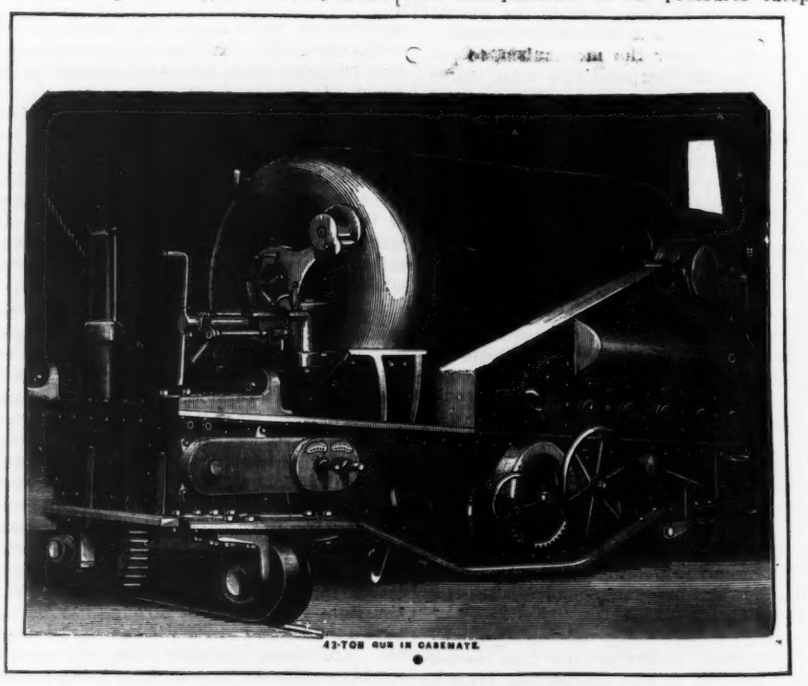


Plate No. 6.—Roke-Mounting for 43-Ton Gun.

*Published in ENGINEERING NEWS by permission of the War Department.

†For fuller description of patents, with drawings, see Armored Minimum-embrasure Gun-carriage (Gruson patent of 1883) as translated by Captain Edward Maguire, U. S. Army, Washington, D. C., 1884.

(1) For details as to the gun and its trials with illustration: see U. S. Ordnance Notes, No. 22; also, page 19 and Fig. 5, U. S. Ordnance Notes, No. 136; also, pages 137 and 139, U. S. Ordnance Notes, No. 113; also, Krupp's original report.

(2) For full details and drawings: see pages 24 to 26 and plates of London Engineer, for 10th January, 1879; also, U. S. Ordnance Notes, No 221.

(3) These carriages are described and illustrated in pages 175, 430, and 438, of U. S. Ordnance Notes, No. 126; and fully in Nos. 5 and 6, "Rivista Maritima," for 1876

(4) For full details (with plates): see U. S. Ordnance Notes, No. 221.

same vertical line as the center of the circular racers upon which the chassis rails, or platform, revolves; these arcs at the roof and the floor of the casemate are furnished with vertical rollers which bear against the vertical cylindrical surfaces of curved iron rails or racers attached rigidly to the roof and floor of the casemate. These upper and lower rails are termed "recoil plates" and must be solidly attached to the upper iron roof and to the lower iron or masonry floor of the casemate. The rectangular girder frame is called a "yoke," and gives its name to this form of checking the gun's recoil. The yoke rolls around on its recoil plates just as the chassis slides on its racers, and the yoke resists all the forward and back motion of the gun, while the chassis has only to hold up against direct vertical pressures. The buffers act by tension, and hang on to the yoke like the arms of a man if in similar position; as they are attached to the carriage alone under the trunnions of the gun, and to the yoke nearly at its mid-height, the strain is transmitted almost directly to the yoke, and almost equally to the roof and floor of the casemate. This mounting, as applied to the 43-ton gun, was tested at Shoeburyness on the 20th July, 1881, and its behavior was said to be admirable. The recoil was under 4 feet, the motion was remarkably smooth and easy.

It is proposed to use this mounting for all new heavy breech-loaders. The 43-ton gun and its carriage will go into any emplacement previously arranged for the 38-ton M.-L. gun[5].

Front-parapet Anchorage.

While at Shoeburyness in 1881, the writer had the opportunity of examining an experimental front-parapet anchorage for controlling the recoil of 8-inch 70-cwt. howitzers mounted on siege carriages behind barbettes. This howitzer uses a cartridge of from 3.5 pounds to 11.5 pounds of R. L. g. powder; when free, it recoils about 30 feet, and is quite unmanageable. The siege carriage, moreover, is one not suited to receive a buffer of the ordinary kind. The idea of the experimental mounting was to obtain, if possible, a "hold-fast" or solid anchorage in the front parapet, and then to insert a hydraulic buffer between this anchorage and the carriage. In the mounting as arranged at Shoeburyness in 1881, a long wooden or iron beam was embedded in the earth of the front parapet, about 6 feet to 10 feet in front of the parapet's interior crest and parallel thereto; to this beam was attached an iron rod extending back until it projected on the rear of the parapet's interior slope; to this rod was attached a hydraulic buffer whose cylinder was fastened rigidly to the carriage. This experimental arrangement gave very satisfactory results [6] and reduced the recoil from 30 feet to less than 4 feet. By this method of fastening, the carriage could easily be detached from one anchorage and moved and attached to another at pleasure.

This mounting might well be modified for larger guns by using a longer front anchorage and connecting it, at least at both ends, to a single iron ring just in rear of the parapet's interior slope. This ring might then be used as a front pintle for the chassis, and at the same time for a point of attachment for one end of a hydraulic buffer whose other end could be attached directly to the upper carriage or even to the gun itself. In this way the anchorage might serve behind barbettes to replace the yoke-mounting just described for 43-ton guns in casemates.

(TO BE CONTINUED).

[5] See page 154 and 29, Vol. 7, Royal Engineers P. P., for 1882; also, page 73, London Engineer, for 29th July, 1881.

[6] See p. 73, London Engineer, 29th July, 1881.

Work on the Mississippi.

REPORT OF THE COMMISSION FOR THE LAST FISCAL YEAR.

WASHINGTON, Nov. 1st.—The report of the Mississippi River Commission, covering its operations from October 1st, 1884, to the end of the fiscal year, June 30th, is made public. The works at various points are briefly described in general terms, and the detailed reports of the officers in charge of each work are submitted as appendices. The commission cites the acts of Congress under which it acts, and quotes from its own previous reports statements of its plans and purposes, which it comments upon. The plan, it says, contemplates the closing of outlets, both low river outlets and crevasses, the concentration of the waterway of the river where the widths are excessive and the navigation bad, and the maintenance of the banks. The total cost of bank revetment between Cairo and Vicksburg up to June 30, 1885, was $2,240,000, and of works of contracting channel $2,500,000. A very considerable portion of the sum expended for bank revetment was designed to give protection to certain city sites and harbors—Memphis, Vicksburg and others. The commission argues at some length in support of the plan of bank revetment as better calculated to secure the desired improvements than channel contraction.

Of the $75,000 appropriated for the salaries and expenses of the commission for the last fiscal year there remained on hand at the end of the year $2,272. Of the $75,000 appropriated for surveys there remained $16,148. The expenditures for improvements from October 1st to the end of the year were $1,636,832, and there remained on hand on July 1, 1885, $389,978 to meet liabilities and carry on the work of improvement. The estimates for 1887 are as follows: For continuing surveys of the Mississippi River between the head of the Passes, near its mouth, and its headwater, $100,000; for salaries and traveling expenses, $100,000; for continuing the improvements from Des Moines Rapids to the mouth of the Illinois River, $500,000; from the mouth of the Illinois River to Cairo, $100,000; from Cairo to the head of the Passes $500,000; for the improvement of the harbor at Columbus, Ky., $80,000; at Hickman, Ky., $270,000; at Memphis, $75,000; at Greenville, Miss., $186,000; at Vicksburg, $20,000; at Natchez, $700,000; at New Orleans, $623,600. The cost of improving the Mississippi River, the commission says, in the manner and to the extent contemplated will doubtless considerably exceed the estimate formerly submitted by the commission. It has been found necessary to make use of stronger, firmer, and therefore more expensive methods of construction than those upon which, from the want of experimental knowledge, that estimate was based, and the percentage of loss from floods has exceeded what was formerly thought to be a fair allowance for this contingency.

Protecting the Washington Monument from Lightning.

The improvements on the arrangement for protecting the Washington monument from damage by lightning are now being made, and will probably be completed within a short time. The disturbed portion of stone work has been very neatly drawn back into its place, and secured by bolts from within. The changes which are being made, with the hope of avoiding all possible injury in the future, are essentially as follows: Around the lower part of the aluminium pyramid which terminates the shaft has been fitted a sort of collar, from which project eight pointed metallic rods, each about three inches in length. To the corners of this collar four copper rods, about one-half an inch in diameter, are secured, extending down the edges of the fifty-five-foot pyramidal apex. These four rods are joined together at a number of points along their length by horizontal strips of metal, each having a cross-section area nearly as great as that of the half-inch rod, but of different form, so as to fit closely into openings along the junctions of the various layers of masonry. All are securely joined to the corner or edge rods; and along both horizontal and edge rods metallic points, similar to those surrounding the base of the aluminium apex, will project at right angles to the rods, and at distances of four or five feet from each other. It will be seen that the great terminal pyramid will thus be covered with a sort of cage of metal rods, from which will project a large number of small metallic points. All of the metal thus placed upon the surface has been carefully plated with gold to prevent discoloration of the stone through the action of the weather on the copper.

The connection of this external cage with the internal conductor seems to be all that could be desired. To begin with, from the base of the small aluminium pyramid a copper rod or bolt, one and a half inches in diameter, extends to the capstone, by means of which it is secured to the latter. From the extremity of this rod four rods of copper, each having a diameter of three-fourths of an inch, proceed downward, and, separating at a distance of a few feet from their upper ends, are led to the four middle piers of the iron structure which carries the elevator and the stairway. This structure extends through the whole height of the monument up to some distance beyond the five-hundred foot level. It consists, in the main, of eight wrought-iron columns, four being six and one-half inches in diameter, and four seven and one-half, and all tied together through iron braces and stays. In addition to the electrical connection of the exterior cage through the aluminium apex, as above described, independent connections of the corner or edge rods to the iron columns are made at several points lower down, by passing one-half and three-quarter inch copper rods through holes drilled in the stone work of the pyramid. At the bottom the earth connection is made by four heavy copper rods, which project several feet into a well of moist sand, at the bottom of which water is always standing.

Owing to the unrivalled height of this monument, its protection from damage by lightning is a matter of scientific as well as of practical interest, and the efficiency of the plan now being carried out will doubtless be questioned in some quarters; but it is a problem which time alone can satisfactorily solve.—*Science.*

Railway Depression in Brazil and the Argentine Republic.

Mr. William B. Wilkins, who recently returned to New York, after spending more than a year in Brazil and the Argentine Republic, as the representative of prominent railway industries of this country, reports that the present railway outlook in Brazil is decidedly discouraging, and that, although it is somewhat better in the Argentine Republic, that country is also suffering severely from the world-wide depression which recently prevailed. In Brazil various causes have helped to injure railway prospects. One of the most prominent, in some sections, is a great decline in the condition of the sugar industry; but apart from this, serious financial difficulties have arisen; the government is refusing to grant any additional railway subsidies, and doubts are expressed in regard to its ability to meet all the payments already authorized, if depression should continue.—*Railway World.*

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CLUBBING ARRANGEMENTS.

1886.

The "subscription season" for the most popular American Magazines is close at hand, and inquiries as to our proposed clubbing arrangements are being made. We beg leave to announce, therefore, that on and after JANUARY 1, 1886, the subscription price of ENGINEERING NEWS will be **$5.00** per year; until that date the price and clubbing rates with other publications will remain as given below.

We are now planning such improvements in ENGINEERING NEWS, and negotiating for special work to be done during the coming year, as will cost double any possible increase of income from subscriptions; the long notice of change which we here give enables nearly, if not all, present subscribers to renew at present rates. We intend eventually to publish a class journal which will acknowledge no superior in the world, and we feel so confident of the support of our present patrons that we have no hesitation in venturing on the greatly increased expense necessary to carry out our programme.

If an English engineering journal, carrying fifty pages of advertisements and twenty four of reading matter sells for $10, why may not an American journal of equal merit sell for at least half as much.

In order to accommodate such of our subscribers as may wish to subscribe for other periodicals, we offer he following terms until January 1, 1886: We will send to any address ENGINEERING NEWS at regular subscription price, **$4.00** and the following at the additional prices given:

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The Century Magazine commences its year with the November Number; Harper's Magazine commences with the December Number. Subscribers should renew these Magazines in October and November.

Subscribers to other publications clubbed with ENGINEERING NEWS, must notify those "other publications" direct, of change of address during the year. After we have transmitted for the year's subscription and had the subscriber's name and address properly entered on he clubbing lists, our connection with the transaction *ceases entirely*. Our margin of five cents on each subscriber does not allow for much extra expense in time and postage and stationary.

THE illustrated description of the late repairs, or virtual rebuilding, of the Cooper Institute in this city, as published in *The Sanitary Engineer* of November 5th, is a useful contribution to architectural engineering. The difference in the practice of to-day and thirty years ago in house-building, is well illustrated in the Figs. 5 and 6; though we must admit that a builder of the fifteenth century or thereabouts would probably have followed the later plan. The repairs are well described and illustrated, and our contemporary deserves credit for its enterprise in presenting material of such value to its readers.

ACCORDING to the report, of June 19, 1885, of M. de Comberousse, President of the French Society of Civil Engineers, the total number of members to that date was 2106. In the year covered by the report, fifty-seven new members were admitted and nineteen died, making a net gain in the year of thirty-eight.

The Society has an invested fund of 282,479 francs, or about $56,500; the annual receipts from all sources were about $18,000.

This society of engineers was founded March 4, 1848, with fifty-six members; in 1860 it had 519 members; in 1867 it determined to have its own building, and in 1872 it took possession of its present quarters, which cost, with the land and furniture, $54,000; upon this building there is still some debt, which is being rapidly paid off, however.

THE English Government is said to intend spending £50,000,000 on railroads in India, with the purpose of opening to commerce, and particularly to profitable wheat growing, large areas, that only require economical transportation for the grain grown on them, to enable them to compete in the markets of the world. The contemplated expenditures are to cover several years.

We suppose that England will get 3,000, or at the most 4,000 miles of road from this expenditure under her system of railroad building. If she would intrust the work to American engineers and contractors, she would have 12,000 to 15,000 miles to show for her money in about half the time she will employ. There is small probability, however, of her acknowledging the superiority of American engineers, but we think it might be well for some of our unemployed contractors to look this point up.

It seems strange to us that Russia in her race to Herat does not avail herself of the skill and energy of our railroad builders; if she would intrust both the transportation of material and building of the road to Americans, she could secure two miles of workable road per diem.

SPAIN is asking England for tenders for steel war-ships, to cost $50,800,000; these include four ships of 10,000 tons each, "speed, 25 knots," and on each two 110-ton guns, to cost $2,000,000 each; besides these she wants fifteen ships of the *Esmeralda* type, 20 knots speed, to cost $1,000,000 each, and forty torpedo cruisers, 120 torpedo boats and six large transports. The Englishmen doubt the ability of Spain to raise the millions, but expect a handsome order.

It does seem to be about time that the United States was awakening to the fact that she both sadly needs a navy for herself, and is missing chances to build war-ships for other countries. We have the money, men and material, and with a little home encouragement in supplying additional plant we can compete with the world in shipbuilding.

A few figures will show why England is so anxious to retain the monopoly in ship-building and would discourage any further growth of that industry in our own country.

In 1883, from $25,000,000 to $30,000,000 was paid out in wages on the Clyde; *Engineering*, of Jan. 18, 1884, is authority for the statement that 52,000 men and boys were employed in ship-building on the Clyde. The value of ships built in England in 1883 was $93,000,000, and less than half of the tonnage and rather more than half of this value is credited to the Clyde alone; if *Engineering* is correct in its estimate of the force there employed, the total number of men and boys engaged in this industry must be about 100,000.

Palmer's Iron Shipbuilding and Iron Co., of Jarrow-on-Tyne, is regarded as one of the most prosperous limited companies in Great Britain. In 1879 the net profits were $220,540; in 1880, they were $282,825; in 1881, $436,440; in 1882, $396,720, and in 1883 the net profit was but a very little short of $1,000,000. In 1884 the profits declined to $644,690, and for the year ending June 30, 1885, the profits were only $66,640, this last being called a "phenomenally bad year." Leaving out of the count the last year, an average of profit of $467,305 per annum is not a bad business showing for one concern, by no means the largest in the country.

Again we say that we are not surprised at England's desire to hold on to this industry and to increase it by building our ships as well. But is it not full time that we as a nation made an effort to regain our old-time supremacy in this direction, and at least divide some portion of this apparently very lucrative business?

AMONG the engineering suggestions of the day, one of the most startling is the late proposition of J. C. Goodridge, Jr., to practically change the climate of the Atlantic coast from Labrador to Florida.

Mr. Goodridge shows by current charts that there is an enormous volume of icy water passing from the Arctic regions by Davis Strait, and through the Strait of Belle Isle, between New Foundland and Labrador, down through the Gulf of St. Lawrence southward until the polar waters are neutralized in temperature about in the latitude of Charleston, S. C. He calls this polar current the "cold wall," and claims that the difference between the climate of frozen Labrador and that of England and the "Evergreen Isle" is mainly due to its influence.

This "cold wall" lies between our coast and the Gulf Stream, and deprives us of any climatic benefit to be derived from the tepid waters of the latter. In this polar current the water is often at the freezing point in the Straits of Belle Isle, and Blunt, in his "Coast Pilot" remarks that as many as 200 icebergs have been counted in these ice-fields in the month of August.

As the temperature and climate of various parts of our earth have been changed since the advent of animal life on our globe, as exemplified in the frozen remains of the mammoth in Siberia, Mr. Goodridge questions whether similar chances are not in some degree within the control of man. From an engineering stand-point the closing of the Straits of Belle Isle is not impossible. At one point this passage is only 10 miles wide, and the water 150 feet deep, with rocky cliffs on either side, from 200 to 1,000 feet high, from which to obtain the material. A rough estimate, he says, should not exceed $40,000,000 as the total cost of such a work, a small amount as compared with the possible benefit.

The scheme does not seem altogether impracticable, and on its face would promise a great improvement over the existing temperature of Labrador. But as this icy current must go somewhere, it might take a revengeful slant across the Atlantic and make it decidedly wintry for England and other lands in that direction. It's a good scheme to discuss, but practically it is usually very unsafe to meddle with Nature's laws and attempt to force her from beaten paths.

To Europe by Way of Hudson Bay.

Jas. MacNaughton, C. E., Mem. Am. Soc. C. E., has returned with the "Alert" from the late Hudson Bay expedition and in a personal letter and enclosures gives us some of his experiences. We abstract them as follows:—

The purpose of the expedition was to test the practicability of a Hudson Bay route to Europe, with especial reference to its value in developing Manitoba and the Northwest Territory of Canada. Comparing the secondary object, or communication between Japan and England, with existing routes, it is found that the distance from Yokohama to Liverpool, via the Central and Union Pacific R. R's. to New York, is in total 10,900 miles; by way of Port Moody and the Canadian Pacific to Montreal, the distance between the above terminals is 10,259 miles; while by way of Port Simpson, on the Pacific coast, Churchhill and Hudson's Bay, the total distance from Yokohama to Liverpool is 8,275 miles. In these estimates all distances by sea are in nautical miles, with statute miles for the railroad portions.

Mr. MacNaughton says that Hudson Straits is navigable, for properly built vessels, for three, possibly four months in the year. The only real difficulty in the whole enterprise is the four or five hundred miles in the Straits where the doorway is blocked by ice; this difficulty he thinks is sufficiently serious to kill any transcontinental route via Hudson's Bay.

A good outlet could be made for all products from Hudson's Bay and its tributary region by building a railroad from the southern extremity of James Bay to connect with the Canadian Pacific R. R., a distance of about 200 miles. This route has been surveyed and is reported upon favorably as a railway location. Hudson's Bay is a sea about two-thirds the area of the Mediterranean Sea and is navigable for from eight months in the year upward. At present the Hudson Bay Co. send their most valuable furs by carriers, etc., overland to the railroads instead of shipping direct to London by vessel.

The mineral wealth of the region is great; coal and iron were found in paying quantities, together with galena, gold, silver, asbestos, copper and copper pyrites. The country promises great possibilities for ultimate settlement. The region around Hudson's Bay is a veritable hunters' and fishers' paradise, and the native Esquimaux he describes as clever, ingenious and thoroughly honest, with more intelligence than they are usually credited for; they can name all the constellations in sight and designate the North Star as "the one that never moves."

The Preservation of Cordage.

Cordage may be preserved by first plunging it dry into a bath made of 20 grammes of sulphate of copper per litre of water, and leaving it in this solution for four days, and then drying. The rope thus absorbs a certain quantity of sulphate of copper which preserves it against parasitic animals and moisture. The salt of copper is fixed either by tar or with soap-water.

For this purpose the rope is plunged into warm tar, and then passed through a double-grooved frame forming a round trough, and finally through a bunch of oakum. In the second method the rope is dipped into a solution containing 100 grammes of soap per litre of water; this combination of soap and copper preserves the cordage better than the tar, and is a simple fixative.—*Le Genie Civil.*

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PERSONAL.

MILES GREENWOOD, one of the Trustees of the Cincinnati Southern Railroad, was found dead in his bed at his residence, in Avondale, Ohio, on the 6th. He was one of the pioneer citizens of the State.

WILLIAM J. WILLIAMS, a prominent contractor, died November 7th. at his home on Morgan street, Buffalo, N. Y. The deceased was well known at Erie, Pa., where he built the Marine Hospital, the Reed House and other fine buildings, and at Toledo, where he built the harbor breakwater. He erected between 1,500 and 2,000 houses and blocks in Buffalo, besides numerous other works in the county and vicinity.

On November 1st, J. J. MCVEAN, Chief Engineer of the Detroit, Lansing & Northern, and Saginaw Valley and St Louis Railroads will assume entire charge of all Buildings, Bridges and Water Stations on above named Roads, and will superintend the construction and repairs of the same. Foremen of all Bridge and Carpenter Gangs will report to him for instructions. T. M. Fish, General Superintendent.

PROFESSOR EDWARD S. HOLDEN, who has just been chosen president of the University of California and director of the Lick observatory, has been for several years director of the Washburn observatory at Madison, Wisconsin. Professor Holden is a graduate of the scientific school of Washington university, St. Louis, and of West Point, where he was instructor in natural philosophy and also in military engineering from 1871 to 1873. He was made director of the naval observatory at Washington in 1873. He left the naval observatory in 1881 to succeed Professor Watson at the Washburn observatory. He now becomes director of the greatest observatory in the world, which will be supplied with the largest refractor ever constructed, supplemented with a full set of the most improved instruments. When completed the observatory will have cost $400,000, leaving $300,000 as a permanent endowment fund. The observatory will be turned over to the university as soon as it is completed.

Hydraulic Appliances at the Forth Bridge.

Mr. Benjamin Baker, C. E., one of the joint designers of this great bridge, thus describes the use of hydraulic power on the works, in a paper before the British Association:

I should be sorry, indeed, to have anything to do with building the Forth Bridge, if hydraulic appliances were not at hand to do a giant's work. Let me shortly describe to you what we are doing there at the present time. More than 42,000 tons of steel plates and bars have to be bent, planed, drilled and riveted together before or after erection, and hydraulic appliances are used throughout. The plates are handled in the shops by numerous little hydraulic cranes of special design, without any complication of multiplying sheaves, the whole arm being raised with the load by a 4-inch direct-acting ram of 6-foot stroke. A total length of no less than 60 miles of steel plates, ranging in thickness from 1¼ inches to ⅝ inch, have to be bent to radii of from 6 feet to 9 inches, which is done in heavy cast-iron dies squeezed together by four rams of 24 inches in diameter and the same stroke. With the ordinary working pressure of 1,000 pounds per square inch, the power of the press is thus about 1,750 tons.

Some 3,000 pieces, shaped like the lid of a box, 15 inches by 12 inches wide, with a 3-inch deep rim all round, were required to be made of ⅝ inch steel plate, and this was easily effected in two heats by a couple of strokes of a 14-inch ram. In numberless other instances steady hydraulic pressure has been substituted by Mr. Arrol, our able contractor, for the usual cutting and welding under the blacksmith's hammer. Hydraulic appliances are also an indispensable part of the scheme for erecting the great 1,700-foot spans. Massive girders will be put together at a low level and be hoisted as high as the top of St. Paul's Cathedral by hydraulic power. Continuous girders nearly a third of a mile in length will be similarly raised. Not only the girders, but workmen, their sheds, cranes and appliances, will be carried up steadily and imperceptibly as the work of erection proceeds, on platforms weighing in some instances more than 1,000 tons.

It is hardly necessary to say that every rivet in the bridge will be closed up by hydraulic power, the machines being in many instances of novel design, specially adapted to the work. Thus the bed-plates, which in ordinary bridges are simple castings, in the Forth Bridge are necessarily built up of numerous steel plates, the size of each bed-plate being 37 feet long by 17 feet 6 inches wide. To grip together the 47 separate plates into a solid mass 3,800 rivets, 1¼ inches in diameter, with countersunk heads on both sides, are required, and, remembering that the least dimension of the bed-plate is 17 feet 7 inches, it will be seen that the ordinary gap riveter would not be applicable. A special machine was therefore designed by Mr. Arrol, consisting of a pair of rams between which the bed-plate to be riveted together lies. A double ram machine had for like reasons to be devised for riveting up the great tubular struts of the bridge.

Exports of Locomotives.

The United States is now sending abroad about $3,000,000 worth of locomotives per annum, the total value of those exported in the last fiscal year being $2,819,946. This, at an average of $10,000 each, represented about 290 engines. In the fiscal year ended June 30, 1882, the number of engines shipped did not exceed 133, the estimated value being $1,455,717. Of the 282 locomotives exported from the United States in 1883-4, 65 went to the Argentine Republic, 49 to the United States of Colmobia and Panama, 34 to Mexico, 32 to Brazil, 27 to the Dominion of Canada, 19 to Chili, 14 to Australia, 13 to Central America, 14 to Cuba, 6 to Spain, 3 to San Domingo, 3 to Sweden, 2 to Venezuela and 1 to England. The London *Colliery Guardian* adds that "the Americans would naturally obtain a good footing for the products of their mechanical skill in North and South America, but it is something for them to have secured customers in such comparatively remote quarter of the world as Australia."

The number actually shipped in the fiscal year ending June 30, 1881, was 99; in the fiscal year ending June 30, 1882, 133; in the fiscal year ending June 30, 1883, 219, and in the year ending June 30, 1884, 282. During the ten years ending with June 30, 1884, the Americans sent 434 locomotives to various parts of South America, 203 going to Brazil, 84 to Colombia, 72 to the Argentine Republic, 37 to Peru and 31 to Chili. The value of these engines was computed at $4,541,165. During the same period of ten years Canada and British Columbia imported 208 American locomotives, valued at $1,908,129; Mexico 167, valued at $1,808,699; Australia 113, valued at $1,079,170; Cuba 88, valued at $772,911; Russia 58, valued at $778,500; Central America 22, valued at $108,222 and Turkey 12, valued at $182,000. "It may also be observed," says the journal named above, "that during the ten years nine American locomotives went to Spain and eight to England, so that the American locomotive export trade has certainly obtained tangible, and, what is more, a growing importance."

It is pointed out that American locomotives have surpassed those from Great Britain in "flexibility" (thus adapting them to new roads in newly developed countries), and to their ability to get up steam with wood as opposed to coke or coal locomotives. It is claimed that British locomotives manufacturers have taken cognizance of these facts, and that such superiority of American over English locomotives no longer exists. But, says the *Colliery Guardian*, "notwithstanding this, the experience of the last four years has shown that American locomotive builders cannot now be driven from countries within a comparatively easy distance of the United States, while even in Australia the American locomotive has acquired a popularity of which it cannot now be readily deprived. The existing state of affairs affords another illustration of the growth of foreign competition in connection with articles in which Great Britain formerly enjoyed a practical monopoly."—*Bradstreet's.*

We are rather surprised at seeing so enterprising a journal as *Bradstreet's* going abroad for information of such importance to American manufacturers as the above. Had this data been obtained from home sources *Bradstreet's* would have found that in addition to the greater "flexibility" of American locomotives, that they were cheaper in first cost, cost less to operate and less for annual repairs than the English-built engines, and average 27,000 miles run as against 17,000 of the latter. We don't wonder at all at the popularity of American locomotives in Australia, even if they did have to win their present standing in the face of bitter opposition and some very unfair treatment originally.

Road Making and Repairing.

The men who have charge of our roads in Ohio are called supervisors, and are elected each Spring. Our townships are divided into what are called "road districts", so that each supervisor has charge of but a few miles of road—often not more than three or four. The tax for keeping up the road is, first, a poll-tax of $2, which is levied on every man between the ages of twenty-one and fifty-five years (and which is often evaded by men who have no property), and a tax of one or two mills on the dollar on all property, personal and real. The tax is almost universally paid in work, and the supervisors' receipt is received as cash for the tax levied on property when we pay our December taxes. The office of superviser is one that few wish to hold; and it is often the case that a few drinks of whisky buy votes enough to elect a man with no interest in the road and but little sense or judgment.

I have paid close attention to road making for many years; and believe I can offer some hints which will be helpful to those who want good roads.

1st. See to it that men of good judgment and character are elected to do this work. The office, though not a desirable one, is important, and it is the duty of good citizens to take their turn in filling it. 2d. After attending to such places in the road as *must* be fixed, begin at one end, usually that nearest your town, or station, and make thoroughly a piece of road each year. Too often the road work is all scattered along the entire line of road—a little here and a little there—so that it makes but little impression on the general condition of the highway. If a fourth or half a mile is made good, the property owners begin to appreciate the value of it, and it is easier to awaken and maintain an interest in the work, and a public spirit can often be aroused which will lead to volunteer work after the tax is expended.

To make a good road, the first important thing is the grading. It is useless to put gravel or stone in a mudhole into which the water will run at every heavy rain. The center of the road-bed ought to be three feet above the bottom of the ditch at the sides. The grading should be done early in the season, so as to allow it to become solid before gravel is applied. It is a great advantage to have a Summer track at the side, as it is easier on horses and vehicles than a graveled road; and this should be borne in mind in grading the road. If beginning at the foundation, coarse gravel may be used for the first coat, but fine is preferable for repairing or finishing a road.

After a road has been once graveled and settled, and begins to need repairs, it is best to apply a small quantity of gravel at a time. Unless it is in a spot which has actually cut through, two inches of gravel at once is more profitable than a larger amount. Any one who has not tried it will be surprised to see how long two inches of gravel, well compacted, will hold, if on a solid road bed. Our supervisors usually put on six inches, and sometimes a foot at a time, and it will be months before it packs solid; while, on a road where there is a large amount of travel, two inches will pack in a week. Where six or eight inches of gravel is put on at once, it does not all pack; but, after the surface is solid, if you will dig down, you will find loose gravel; and this holds water, and makes the road heave and become spouty after a hard freeze. It will cost no more to apply six inches of gravel to the road at three different times, than to do it all at once; and it is my judgment that it is worth to the road nearly double if applied in this way.

Almost all of our supervisors make a mistake in putting all of the work to be done on the road for a year at one time, and leaving nothing to be used in repairs for three-fourths of the year: and, usually, after the gravel is spread nothing more is done. If you will travel on any of our country turnpikes in the fall, you will find that nine out of ten of them will be a little lower at the wheel track than at the outer edge; and as a consequence, whenever a heavy rain falls, it either stands in the track, or runs, if there is a slope, accumulating as it flows, and washing the road. It is not uncommon to see a stream follow the track for a quarter of a mile before it turns off into the ditch. Every road that is fresh graveled should be gone over with a garden rake as soon as the wheels have packed the track solid, and the loose gravel from the outside drawn in on to the track; and, wherever there is a depression so that the water can stand, a little channel should be opened to drain it into the ditch. In riding over a turnpike after a heavy rain, you will often see small pools of water, one or two inches deep, and containing from a few gallons up to a barrel or more. If attended to at the proper time, often a single load of gravel would fill a dozen of them. If the water is left standing in these holes till it evaporates, every wheel that passes through it cuts a little, and carries away a little of the material, so that at the next rain it will hold a little more water. I have seen on an otherwise excellent turnpike fifty of these places to the mile; and half a day's work with a garden rake, at the proper time, would have prevented nine-tenths of them. I think that there should be a load or two of good gravel dropped at the side of the road every eighth of a mile or so, to be used in filling these small depressions as soon as they can be noticed, and that it would be as economical as the "stitch in time that saves nine."

Another use of the garden rake on the road is to rake out the stones. It is astonishing that teamsters will allow their teams to draw heavy loads up long hills covered with loose bowlders, varying in size from a hen's egg up to 4 inches in diameter, when an hour's work with a garden rake would clear a hill a hundred yards long of them. There are roads in my township where there are from a dozen to fifty of these loose stones to each rod, and that have lain there for months, some of them for years, and yet it would pay a man to rake them off, if he had three days' work for a team on the road.

There is no greater comfort than good roads; and to have them we must act intelligently, and do the work at the right time and in the best way. It is quite a tax to make and keep them in repair; but there is no tax that pays the farmer so largely in comfort, and ease of marketing his produce, and also in the enhanced value of his farm. I have lived thirty-seven years where I now do; and for the first ten or twelve I toiled during the open Winter and every Spring through mud that seemed bottomless. Then we constructed a free turnpike; and every dollar it has cost me has been returned fourfold in the increased value of my farm, and tenfold in the comfort and satisfaction I have enjoyed.—W. F. BROWN, *in the Cultivator.*

The Prospects of Railroad Building.

The *Railway Age* has continued its statements concerning the prospect in railroad work. An editorial in a recent issue has called out a letter from Mr. Edward Atkinson, of Boston, the eminent statistician, in which he alludes to estimates published by him some time since. The *Railway Age* has followed up his reasoning. Mr. Atkinson divides the States and Territories into five classes on the following plan:

Class I is assumed to need very soon a railway service equal to that of Massachusetts at the present time, to wit, 1 mile to 4 square miles; Class II, one-half as much, or 1 to 8; Class III, one-quarter as much, or 1 to 16; Class IV, one-eighth as much, or 1 to 32; Class V, the present Territories, one-sixteenth, or 1 mile of railway to each 64 miles of territory. Class I comprises Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, Ohio, Indiana, Illinois and Iowa. These 11 States had January 1, 1881, 39,975 miles of railway in operation, and, judging by the past, Mr. Atkinson estimates that within fifteen or twenty years from that date, or, say, by A. D. 1900, they will need 36,236 miles of additional railway, bringing them then on an equality as to area compared to mileage with Massachusetts at that date, although it should not be forgotten that even Massachusetts is still adding to her railway mileage, and hence that the standard assumed for 1881 is constantly varying.

Class II, which is assumed to need only half as much mileage in proportion to area as the foregoing, consists of New Hampshire, Vermont, Michigan, Wisconsin, Missouri, Virginia, West Virginia, South Carolina, Georgia and Kentucky, and they are assumed to need 27,199 miles of additional road in the time named. Class III comprises Minnesota, Nebraska, Kansas, North Carolina, Tennessee, Mississippi, Alabama, Arkansas, Louisiana, Texas and Indian Territory, with a need assumed of 34,472 miles more. Class IV consists of Maine, Nevada, Colorado, Oregon and California, lacking 9,652 miles. Class V is composed of Florida, Dakota, Wyoming, Washington, Montana, Idaho, Utah, New Mexico, and Arizona, needing 9,888 miles in the time named.

This shows a grand total of 117,447 miles which this authority estimated would be needed, in addition to the 91,778 miles in operation January 1, 1881, within fifteen or twenty years, making a grand total of 209,225 miles—to which should be added about 2,000 for Massachusetts, expected to be in existence in that time. Now, this seemed to many a wild prediction, as it required the construction, on the average, of from 5,870 to 7,830 miles, according to the period, for every year

in the next fifteen or twenty. Now, let us see how Mr. Atkinson's prediction has come out thus far. Taking his figures and figuring out also the mileage built in the four years which have intervened since the date from which his prediction starts, we fined the following:

Group of States.	Mileage still needed from Jan. 1, 1881.	Mileage built from Jan. 1, 1881, to January, 1885.	Per ct. total estimate built in 4 years.	Mileage still needed before A. D. 1900.
Class I.....	36,236	8,597	24	27,639
Class II.....	27,199	5,282	19½	21,917
Class III.....	34,472	8,351	24	26,121
Class IV.....	9,652	2,893	30	6,759
Class V.....	9,888	5,857	59	4,031
Totals.....	117,447	30,980	26.3	86,467

It will be seen that Mr. Atkinson's forecasting has been remarkably well justified by the first four years of the period under consideration, over 26 per cent. of the expected mileage having already been built. If this average is maintained the supposed 117,000 miles and over will have been completed in just about fifteen years. In two of the four years the amount of yearly construction was the largest ever known; in the remaining two years a very great falling off was experienced. The average for the period was 7,745 miles per year. To complete in eleven years more the remaining 86,467 miles assumed—making the total period fifteen years—will require a yearly average of 7,860 miles, while if is not accomplished until 1890 the average required will be only 5,764 miles per year. Neither of these yearly amounts is impossible of accomplishment—perhaps not improbable.

Of course the foregoing figures, so far as they relate to the future, are mere speculations, but in the light of what is already accomplished they are interesting as showing that the future may to some extent be judged from the past, and also because they tend to confirm the indications of large railway construction given in the tabular statement of mileage projected and in progress in our issue of October 1. It will be noticed that in Class V, the group of least anticipated construction in proportion to area, Mr. Atkinson's estimate was much too low, since more than 59 per cent. of the mileage which he predicted for the entire period named was already built at the end of four years, while in several of these States and Territories, notably Florida and Dakota, construction is still proceeding rapidly, and is certain to greatly exceed the total assumed for the next fifteen years or so. On the whole, says the *Railway Age*, history and geography seem to join with the indications of activity now apparent, and with the predictions which are ventured by those given to theorizing for the future in promising a period of large railway construction throughout the country.

Railroads in China.

TRYING TO INTEREST CAPITAL IN A SCHEME TO GRIDIRON THE CELESTIAL EMPIRE.

Baron de Lorme, formerly of the French Army, but of late years traveling and following the profession of engineer, has been in this city for about two months past trying to interest capitalists in the construction of railroads in China. He has made four visits to that country of sufficient duration to have become conversant with the language, and came here from there. His efforts for the railroad project were desultory and yielded little except vexation. About two weeks ago he put his case in the hands of Nathaniel McKay, who sent letters to twenty-five or thirty men in various eastern cities, most of them belonging here, asking them, to meet Baron de Lorme last evening at the Fifth Avenue Hotel in order that he may submit his plans. The letter summarizes the project and makes what appears to be a tempting and plausible showing; so much so that Mr. McKay anticipated a good meeting, a number of gentlemen having signified their intention of being present.

The need of railroad transportation, it is stated, has long been felt in China. It became urgent during the late troubles with France, when the difficulty of getting troops to the scene of action was exceeded only by the difficulty of getting them out of reach in time of danger. There are 2,500 miles of water front in the empire, a river 2,900 miles long, and settlements of from 40,000 to 50,000 inhabitants are as plentiful as autumn leaves. The Government having determined to do something, a comprehensive plan was devised and the American railway system, as illustrated in Government help for the Pacific railroads, commended itself with more favor than any other, and conditional guarantees were made which Baron de Lorme came here to submit.

The Chinese Government, according to Mr. McKay's letter, proposes to build the roads. It wants to put the immediate work in charge of contractors whose means, influence, and character will insure their doing what they undertake. The names of the persons composing the contracting company must be a guarantee to the Government that the work will be done as agreed. Grants for the road or roads will be made to the corporation, to whom bonds will be issued as a Government loan. The Government is to insure the payment of the bonds and interest. Bonds will be delivered to the corporation in portions on the completion of each section of road of twenty-five miles. They will not constitute a first lien on the road, and the corporation shall have the right to issue first mortgage bonds, as was done in the case of the Union and Central Pacific Roads.

Mr. McKay says that Chinese bonds are quoted in London at 111 and 112½, which shows, he thinks, that the credit of that Government may be relied on to push to completion an undertaking however vast. Baron de Lorme proposes, if successful in forming a company, to return to China, leaving here on November 25th., and to take with him at his own expense, engineers to make the needed surveys. Should he not be successful here, he feels certain that he can raise a European company for the enterprise.

Mr. McKay says the Baron is waiting here only to satisfy the preferences of those from whom he comes. The Baron will submit to those whose business it may be to see them testimonials from the French Minister at Washington and from other high sources.

WATER

COLORADO is said to contain 3,000 artesian wells.

VICKSBURG, MISS., is in the field for water-works.

WELLSBORO, PA., has decided to have water-works.

DANBURY, CONN., is investigating sewerage systems.

COMMISSIONERS have been appointed to investigate the water supply question at South Abington, Mass.

THE West Point, Nebraska, water-works are near completion.

THE Appleton, Wis., Electric Light Co., will begin to supply its customers about December 1st ensuing.

ASBURY PARK, Nov. 12.—The authorities of Ocean Grove and Asbury Park met yesterday to discuss the difficulties that have recently arisen in the boring of artesian wells for Asbury Park's water system. A well recently bored has tapped the vein supplying the Ocean Grove wells.

WENONAH, N. J.: November 12th.—The water company here has signed a contract with R. D. Wood & Co., of Philadelphia, to construct their water-works, and be ready to turn on water by January 15, 1886. The extent of the street piping to be laid to begin with will be about 6000 feet. The water supply will be a pure spring near the town, and the system will be wooden tank, with sufficient elevation to give pressure for ordinary purposes and direct pumping for fire pressure

THE artesian well now being bored at Americus, Ga., is 1,360 feet deep, and the indications are good for water.

LITCHFIELD, ILLS., is to be lighted by natural gas by January 1st, from a well one and a half miles distant from the town. Van Vleck Bros. own the well.

THERE are 634 light-houses along the the coast of the United States, and one-fifth of them were constructed last year.

A GAS company has been organized at Colorado, Tex., with a capital of $20,000. Works will be established immediately.

THERE is a little misunderstanding between the Council Bluffs Council and Mr. Benezette Williams, engineer of the sewerage system of that city.

THE Board of Public Works of Jersey City, N. J., are to furnish the city of Bayonne with water, the water furnished to be measured by meters.

SUPERINTENDENT ARMSTRONG of the Allegheny, Pa., water-works, has sent in his resignation to the Water Committee.

THE Pond Engineering Co., of St. Louis, have closed contract to furnish the pumping machinery for the El Dorado, Kan., water-works.

TOLONO, ILLS., Nov. 6.—The natural gas wells of Tolono are gradually failing, and no new ones have been discovered for a year.

THE biggest water tank and wind mill on the Kansas Central Railroad was completed at Winchester, Kan., last week.—Winchester *Argus*.

DURING October 11,838,256 gallons of water were pumped by the Duluth, Minn., water-works, a daily average of 381,879 gallons.

THE water supply has measurably failed at Galesburg, Illinois, and the city has brought suit against the water company to annul its franchise.—(Exchange.)

OHIO INCORPORATIONS.—The Buckeye Gas, Oil and Pipe Line Company of Bowling Green, capital stock $500,000; the Leipsic Natural Gas and Oil Company, capital stock $10,000.

AMSTERDAM, N. Y.—Prominent citizens are making strenuous efforts to have electric lights introduced into the city. A representative of the Ilion electric light company has been in the city conferring with certain gentlemen in regard to it.

WORK on the artesian well at Scotland, Dak., was stopped recently after reaching a depth of 536 feet, and as it had reached a rock resembling Sioux Falls granite, it was deemed unadvisable to go any further. The flow now is about 400 barrels a day.

THE city officials of Pensacola, Fla., have closed the contract for water-works with Daniels & Howland. W. B. Richards, Superintendent, and Chief Engineer, Atlanta Water-Works, has been Advising Engineer at Pensacola.

A PLANT has just been completed at McKeesport, Pa. by Henry Lauth., of that city, and Col. Wm. McCarthy, of Maryland, for the purpose of converting natural gas into illuminating gas, and for making "water gas." The productive capacity of the plant is 75,000 feet of gas per day.

COMMON Councilman Lobaugh, of Allegheny, estimates that it will cost Allegheny alone $100,000 to clean up and repair the damage incident to the laying down of natural gas pipes, and to put the street in good condition.

THE Shickle, Harrison & Howard Iron Co., St. Louis, have just completed contracts for furnishing all the cast-iron pipes for new water-works, at Chippewa Falls, Wis.; Urbana, Ill.; Mattoon, Ill.; Menominee, Wis.; Moberly, Mo., and Marion, Iowa. At the present time they are filling contracts for Mexico, Mo.; Omaha, Neb.; Hot Springs, Ark.; Los Angeles and Sacramento, Cal.; Kansas City, Mo., and Olathe, Kan.

THE PROPOSED QUAKER BRIDGE DAM.—Orlando B. Potter and William H. Webb, told the Aqueduct Commissioners on Wednesday, that they would not be prepared to discuss the feasibility of constructing the new Quaker Bridge dam and reservoir until an opportunity had been given them to examine further into the matter. An adjournment for two weeks was then agreed upon. At the next meeting, besides the Quaker Bridge dam and reservoir, there will be considered the advisability of constructing the Muscoot dam and reservoir at Muscoot Mountain, about six miles above the present Croton dam, and a dam and reservoir on the east branch of the Croton river, and commonly known as the Sodom dam and reservoir I.

The following estimates of the cost of the Quaker Bridge dam and reservoir were presented: Quaker Bridge dam, gatehouse, subsidiary dam, overflow and temporary dams, etc., $4,027,600; Muscoot dam, etc. $300,000; roads and highways, $410,500; bridges, "A" to "P," $415,000; railroads, (elevating, etc.,) $190,000; clearing basin, $200,000; total, $5,543,100.

THE Bayfield, Wis., hydraulic company have let the contract of putting in new iron street mains. The work contemplated this fall will be laying a 6 inch main from the reservoir on Broad street to Fant avenue. The company will not build a new reservoir till next spring.—*Lake Superior News.*

ABILENE, TEX., November 4th.—A large quantity of machinery and cast-iron pipe arrived to-day for the Abilene Water-works. There will be about four miles of mains, thirty-five hydrants, and a water tower 100 feet in height by 14 feet in diameter. The contractors are required to have the works completed on or before the 1st of March next.

A COMPANY has submitted a project to the citizens of Sing Sing for providing them with pure water for fire and domestic purposes. The plan is to draw the water from Rockland lake, in Rockland county, directly opposite Sing Sing. The water will be carried across the Hudson, which is at that point four miles wide, in iron pipes, to be laid on the bottom.

THE City of Brooklyn has recently been making extensive improvements to Baisley's Pond, Jamaica South, and to facilitate the flow of water through the conduit, the average depth of the pond is to be one foot. This will necessitate an enlargement of the area of the bed, and the farmers who own adjacent lands will be asked to sell to the city. Engineer Asa Hendrickson will soon make a survey for the improvements.

HYDRAULIC MINING.—A solid stone dam has been built across the Platte river above Montgomery, Col., to enable the Sovereign Mine Company to conduct any desired amount of water to any point of the placers for hydraulic purposes. The company has advertised for bids for the construction of an immense canal, through which the waters stored in this great reservoir can be taken along the sides of the mountain and utilized for grand operations at a score of points known to be immensely rich in placer gold. The Alma *Bulletin* has the following regarding the Sovereign and the Park county properties:

The dam for the new reservoir at the Sovereign mill is about completed, and the same will soon be filled with water, furnishing an unfailing and abundant supply for the mills during the winter. The road to the upper levels of the mine will be partially under water, and hence a new road is being constructed. We presume that this great reservoir will also be the head of the large placer ditch that the company is now offering to receive bids for. The latter will furnish water for the numerous giant hydraulics that will be playing on the Sovereign auriferous gravel beds along the Platte between here and Montgomery, when the same are opened next summer.

RACINE, WIS., November 3rd.—The agitation of the water-works project in this city will probably amount to nothing. There is a law now existing that no new debt shall be created by the city, or bonds issued, except for schools and bridges, until the present city indebtedness is reduced to $40,000. There is apparently no getting around this law, and it cannot be amended or repealed until the legislature meets, which is not until a year from this winter.

LIGHTED BY NATURAL GAS.—JAMESTOWN, N.Y.—Oct. 28 Natural gas is burning to-night from several tall standpipes in the streets, making a roar that can be heard over half the city. It took the vapor 30 minutes to come here from wells at Ludlow, 30 miles away. The Pennsylvania Gas Company owns the plant and has invested over $500,000. A number of Standard Oil Company men are heavily interested in the speculation. There are 40 miles of pipes in the streets, and the manufacturing interests are expecting to receive a decided boom from the use of the cheap fuel. In hundreds of households the gas will be used for both fuel and light.

BINGHAMTON, N. Y., Nov. 9.—On the farm of Harper Dusenbury, one mile east of Union and eight miles west of this city, a large vein of natural gas, which was struck on Friday last, being ignited has burned with great clearness since, with a flame as large around as a barrel. There is no apparent diminution of the supply. This morning at 5 o'clock another vein was struck at the water-works in the east part of the city, where artesian well men are boring for water. It forced its way up through nearly 600 feet of water, burned brilliantly some hours when lighted, and finally died out. A company was also formed to bore for gas southwest of the city where it is believed to exist.

BINGHAMTON, Nov. 11.—The Water Commissioners of this city called a meeting this evening of the prominent citizens and property-owners to advise with them as to the feasibility of sinking the well at the water-works any further. The well has been sunk 611 feet without a sufficient flow of water, although gas in moderate quantities has been struck, coming up through 570 feet of water in the 8-inch pipe at the time. The prospects of gas seemed to influence all present, and it was unanimously resolved to continue the work to a depth of at least 1,000 feet. Opinions are freely expressed that gas will be found in large quantities.

THE Elkhorn Valley Railroad's water supply is inadequate for the increased traffic of the road. Steps have been taken to supply a sufficiency of that important fluid.

THE German Government has called a conference to meet at Berlin for the purpose of making an international arrangement for properly lighting the coasts throughout the world in the interest of navigation; also to arrange with barbarous tribes for the protection of wrecked crews.

THE failure of the natural gas wells of Champaign, Ill., indicates that the supply in the vicinity of Pittsburg and elsewhere may not be inexhaustible. But those who have invested millions in gas wells and pipe lines would not be ruined if their subterranean supply should fail, for it is said that artificial gas for fuel can be made with the refuse coal now lying at the mouths of Pennsylvania coal pits and delivered through pipes to consumers at a price but little higher than that of the natural gas which the pipes now carry.—*N. Y. Times.*

CROES' STATISTICAL TABLES OF AMERICAN WATER-WORKS are making things warm for the Water-works Company of San Antonio, Texas. The enterprising editor of the San Antonio *Light* bought a copy, and each week since we have seen some comparative statistics concerning water supply; the latest outcome of the editorial studies in water-works engineering is the following:

"Few persons can form an idea of the extent of the water-works monopoly in this city. Under the present oppressive contract with the water-works company, the city now pays at the rate of $20,125 a year for the use of fire hydrants, while the actual loss from fire will hardly reach half that amount. This contract has yet eighteen years to run, which would amount to $362,250, should the number of hydrants not increase in that time; but it is fair to presume that they will be doubled at least, and that the city will pay the water-works company the sum of $600,000 to $700,000, at least, before the expiration of the contract. Then the city will have to pay for the works, providing it wants to rid itself of this excessive expense, which a fair calculation would put to at least $1,000,000.

There is a gentleman in this city who proposes that the city buy the works and then he will pay the interest on the bonds and the sinking fund, and turn it over to the city free of cost at the end of thirty-five years, he asking only the privilege to continue the present water rate to private consumers. By this means the city would get the use of the water for fire protection and parks and public buildings free, and the water-works at the end of thirty-five years, without paying out one cent.

The possibility of such a proposition being made and carried out plainly shows the immensity of the water-works monopoly of this city, and if said party can make money in carrying out his proposition, is it not almost criminal for the city authorities to continue the present ruinous contract with said company, and why should not the city run it on its own account and get the benefit of the water supply? The profits to be derived from the water-works and what could be saved from hydrant rent would establish and maintain a system of sewerage that would place this city ahead of any other in the South, and there might be a little left for street improvements."—San Antonio *Light.*

ARTESIAN WELLS.—We must attribute the many artesian wells lately sunk in the South, largely to the World's Exposition. There were of course wells of this kind before the Exposition, among them several very notable and successful ones; but it is only recently and since we were made acquainted with the boring machinery of this kind exhibited at the Exposition—and there were a number of these exhibits—that these wells have grown into popular favor as affording an inexhaustible supply of fresh, pure water, when this is otherwise difficult to find.

The activity in the construction of artesian wells in and around New Orleans during the past year has been striking. They have been dug at several points along the coast, and in many interior towns, and quite a number have added to the water supply of this city, while others are now under contract here.

In all instances save one, they have been a success. An attempt to sink one at Atlanta proved a failure, no water being obtained at a depth of 2000 feet, when the undertaking was finally abandoned. With this exception, water in abundance and of an excellent quality for drinking or manufacturing purposes, has been obtained at a quite uniform depth of from 400 to 500 feet.

The utilization of this means of improving our water supply promises to prove quite a boon to New Orleans, which has always found some difficulty in getting a sufficiency for drinking purposes. The artesian wells promise to make this deficiency good and to furnish as much water as we need. Most of the wells have been constructed for factories, hotels, etc., but it is probable that one will soon be sunk in Lafayette Square for the use and advantage of the public.

The work seems to be only just begun, and from the interest taken and the orders given we may expect, within a year or so, to have ten new artesian wells for every one we now posses.—New Orleans *Times-Democrat.*

COMMISSIONER FLEEMAN has suddenly come to the conclusion that he must have work on the extension of the water-works begun before his retirement from office. Chief Engineer Van Buren will not be ready with his plans and estimates until the middle of the month at the earliest. The land and water rights for upward of five miles have been secured.—Brooklyn *Eagle.*

ALBANY, GA., November 6.—The drill in Colonel Nelson Tift's artesian well has reached the water bearing stratum at a depth of 730 feet, and the outflow is 100 gallons per minute. He will continue to go deeper, however, in order to increase the volume, so as to supply all of north Albany with the water. This makes the eighth well within the city limits, and the last two that have been bored have demonstrated that after the water has been once reached a few feet additional will double the flow.—Atlanta *Constitution.*

FOUR more gas lighted buoys upon Pintsch's principle have been sent off from Paris to the Suez Canal to join the eight already doing satisfactory duty there. The buoys are charged with compressed oil-gas, and will burn for days or weeks, according to size, without any attention whatever. The first of a new pattern of gas-beacon on the same principle is to be put up in the Clyde on the Gantoch Rocks. It has two red lights, and will burn for five weeks with one filling of gas.

BIRMINGHAM, ALA., November 5.—When the Birmingham water-works company (new corporation) sought several months ago to condemn Five-mile creek for the purpose of bringing that stream to the city, it was met by an injunction obtained by the property owners, who claimed that they would be damaged $250,000. A stubborn fight ensued, which has lasted three months. The jury brought in a verdict to-day, giving the property owners only $8,000. This means that Birmingham will have two water-works, and insures cheap rates, as the Elyton company say they will give their water away before the new company shall have their customers.—Atlanta *Constitution.*

WATER FROM ARTESIAN WELLS.—COHASSET, MASS., November 6.—For some time there has been a great deal of talk about a system of water-works, and arrangements have been made with an engineer to make surveys and report the probable expense. A well has been driven to a depth of 40 feet, 24 feet of which was through a strata of solid clay. Below this clay is a bed of coarse gravel, in which it is estimated there is water enough to supply with sufficient wells all the towns within a radius of twenty miles. The well is being driven by Calvin Horton & Co., of Somerville, the same party who recently put in the water system at Hyde Park.—Boston *Globe.*

NEW ORLEANS, Nov. 6.—About eighteen months ago permission was granted by the council to Mr. Adicks to construct gas-works and lay mains in the city contingent upon security in the amount of $100,000 in bonds being put into the hands of the city's fiscal agent as a forfeit, and the Mayor now proposes to claim the forfeit, as none of the promised work has been done. Meantime the attorney for the Myra Clark Gaines estate, holding a judgment against the city, has filed a claim for the amount. Active litigation is likely to ensue. Those in the Adicks interest do not acknowledge the forfeiture, claiming that they have eighteen months extension according to the conditions of the charter.

AN IMPORTANT DECISION.—The universal answer of the friends of the water-works, who are few enough, is that there is no remedy; that although the contract with the city may be oppressive, there is no escape. Such a spirit is that of abject slaves, who deserve tyrannical masters, and of worthless drones. Where there is a will there is a way, and especially is this so in regard to the city ridding itself of the financial incubus that has fastened itself on it in the way of a contract with the water-works company. The contract with the city proposes to debar any other party or company from erecting water-works in this city. This is clearly unconstitutional and of no force. The city can permit or authorize any other company or person to erect and maintain water-works, and can rent hydrants from the same if so disposed. A recent decision on this subject may be of interest, which is copied from the *Sanitary Engineer* of October 15: "The Syracuse, N. Y., water company, which has supplied that city with water since 1849, has been opposing the licensing of a rival water company by the city authorities, and obtained an injunction restraining the city from taking such a step on the ground that its franchise gave it the exclusive right to supply water. This injunction has been dissolved by Judge C. P. Williams, in an elaborate opinion, in which he holds that the franchise and rights of the old company were not exclusive, and that the city has a right to grant a franchise to another company or to construct other water-works itself." The Constitution of this State is even more explicit in so far as to prohibit the creation of a monopoly in any form by any authority, not even the State Legislature, and it has so been decided every time the question has come before the Supreme Court. *San Antonio Light.*

CLEVELAND, O., Nov. 6.—One of the wells recently drilled at Findlay, O., for natural gas, was "torpedoed" to-day, and a stream of oil shot eighty feet into the air. The well is now flowing at the rate of 300 barrels per day, and to a height of forty feet. There is great excitement in the town.

TARENTUM Pa., has grown so much recently that water works is now projected for the town. An application will be made to the State Department in two weeks for a charter for the "Tarentum Water Company," which will be composed of the following parties: John W. Hemphill, Albert Hare, H. Logan Weaver, John F. Scott, B. Ford, Emory L. Ford and William Scott.

THE Lawrence Machine Shop of Lawrence, Mass., find the calls for their pumps very large, and their sales rapidly increasing. Among the unsolicited orders they have recently received one from the Somerset Fibre Co., of Waterville, Me., who were so well pleased with the work of a pump ordered in August, that they duplicated that order on October 27th.

CHICAGO, November 5.—The Farmers' Loan and Trust Company of New York filed a bill in the United States Circuit Court, yesterday, against the Galesburg, Ill. Water Company, to foreclose a trust deed securing an issue of $150,000 worth of bonds by the defendant. The company, it is charged, defaulted on the interest coupons due Aug. 1, 1885. John C. Stewart was appointed receiver, in a bond of $2 000.

THE City Council of Huntington, West Virginia, is considering the advisability of boring for an artesian well. Starting from a hill back of the city, 200 feet above the city level, they expect to reach at the depth of 600 to 700 feet water that will rise to the surface and furnish a supply of natural flow. If this experiment is successful suitable works can be built at a cost of from $50,000 to $75,000. The experiment will not cost over $2,000.

WATER: Its Composition, Collection, and Distribution. By JOSEPH E. PARRY, C. E., Engineer in charge of Liverpool Water-Works. Subjects treated: Composition of Water and Sources of Supply—Purification of Water—Modern Water-Works in England—Distribution of Water—Water Rents, Rates and Charges—Water Appliances for Domestic Supplies—Waste of Water—Rural Supplies—Water for Trade Purposes—Regulations for the Prevention of Waste and Misuse of Water. Price, $1. Sent postage paid, by ENG. NEWS PUB. CO.

THE amount of water present in freshly cut wood is very different, as is shown by the following table, by Scheubler and Hartig: Hornbeam contains 18.6 per cent. of water; willow, 26 per cent.; ash, 28.7 per cent.; birch, 30.8 per cent.; oak, 34.7 per cent.; pine, 39.7 per cent.; red beech, 39.7 per cent.; elm, 44.5 per cent.; larch, 48.6 per cent. and white poplar, 50.6 per cent. Wood, when dried at 266 degrees Fahrenheit, at which temperature all of the hygroscopic water is expelled, is composed of fifty parts of carbon (inclusive of one part of ash), and fifty parts of chemicals.

DENVER, Col., Nov 10.—Information from a reliable source has reached here of the discovery of a remarkable flow of petroleum from the rocks in the Big Horn country in Northern Wyoming, east of the Yellowstone Park. A large lake of oil extends for nearly 500 feet along the side of a rocky bluff, from which it constantly drips, and at any point along the crevice it can be gathered at the rate of a quart a minute. Samples of it show an absence of the heavier elements like asphalt. The surveyor who mapped the ground for the discoverers, expresses the belief that this discovery has no equal in the United States.—*Evening Telegram.*

THE sewerage question at Athol, Mass., which is now agitating the lower village and was at first passed over at town-meeting, was finally referred to a committee consisting of I. L. Cragin, Gardner Lord, Dr. H. M. Humphrey, J. M. King and H. R. Stowell. Three hundred dollars has already been spent in investigations and plans. The trouble arises from the lowness of the land on which the village is built. The fall to the river is very slight. Most people think that some system of dry night soiling, which can be introduced without much expense at first and yield some return in fertilizer saved, will be preferable to sinking a large sum in expensive works.—Springfield *Republican.*

WATER PURIFICATION.

HACKETTSTOWN, N. J., Nov. 10, 1885.

EDITORS ENGINEERING NEWS:—We are troubled by roily and muddy water entering our reservoir and filling pipes with muddy water.

Will you please inform us where we can get information for best method to prevent it, and also for "Water Filtration," and oblige,

Yours truly,
JOHNSON BROS.

[We leave the first question to be answered by parties who have had experience in the matter; at the meeting of the American Water Works Association, held in Buffalo, in 1883, an excellent paper on "The Filtration of Public Water Supplies in America," was read by J. J. R. Croes, and was afterwards published in the 1883 report of the Society, and also in ENGINEERING NEWS of June 16, 1883, copies of which are out of print.—ED. ENG. NEWS.]

Bradstreets', of November 7th, contains a letter from a Chicago "Engineer" relating to the water supply and drainage of that city. After describing the water supply by tunnel and its need for extension, "Engineer" shows the various methods adopted for draining the city. In speaking of the Des Plaines River, he says this stream flowing southward with a somewhat rapid fall and passing Chicago at a distance of eight or ten miles, is the main affluent of the Illinois River which reaches the Mississippi 300 miles southwest of Chicago. The Illinois River is practically navigable to La Salle where the Illinois and Michigan canal empties into it, and this canal follows the valley of the Des Plaines to Summit, about ten miles southwest of Chicago. The canal is ninety-six miles long, has 6 feet of water and was opened in 1848 at a cost of $6,000,000. It was originally intended to reach Lake Michigan by open cut, but to save expense this plan was modified and the summit-level built thirty miles long from Chicago to Lockport and 8 feet above the lake level. Between 1865-70 the summit level was deepened at the expense of $3,000,000 to improve the drainage of Chicago, and the Bridgeport pumping station, originally built to supply the summit, was operated to force the stagnant waters of the south branch into the canal; the centrifugal pumps, erected in 1883, were designed to lift 60,000 cubic feet per minute, the eight feet lift. Near Summit where the canal reaches the Des Plaines valley, the river surface is 5 feet higher than the lake for many miles, but at Lockport, twenty miles from Summit the river has fallen to a level of 32 feet below the lake. A committee of citizens, acting independently of the Chicago authorities, now urge the enlargement of the canal from Bridgeport on the south branch to Summit, and the deepening of the Des Plaines from Summit to Lockport, so th t the entire sewage of Chicago may be diverted from the lake down the Des Plaines. In order to restrict the Des Plaines flow it is proposed to intercept that stream, as well as the upper part of the north branch of the Chicago River, and turn them into a lake six or seven miles north of the city, thus reducing the water-shed to be provided for down the Des Plaines from over 1,000 square miles to about 250, and maki g good whatever the river may need by drawing freely from the lakes. The committee now want a commission of thoroughly competent engineers to investigate the who'e subject and report their conclusions.

NEWS OF THE WEEK.

Railroads, Bridges and Canals.

The Elkhorn Valley R. R. Co. are making a new survey from Fremont to Lincoln, Neb.

Cable R. R.—A new cable street railroad has been opened in Binghamton, N. Y.

Colorado R. Rs.—Colorado has 2,413 miles of railway, valued at $20,734,761.60.

Removal of Shops.—All the repair shops of the West Shore Railroad are to be removed from Syracuse to Newark, N. Y.

Cuban Railway Opened.—The railway between Holguin and Gibara, Cuba, was opened on the 6th with great festivities.

Northern Pacific Contract.—The Northern Pacific will shortly award contracts for the construction of a tunnel through the Cascade range. This tunnel will be one and nine-tenths miles long, and will cost about $750,000.

R. R. Survey.—Engineer Barclay, of the Canadian Pacific, has started from Lethbridge, N. W. T., via Fort Conrad, for the purpose of looking out a route for the railroad branch between Fort Benton, Mont., and the main line of the Canadian Pacific.

Steel Ties.—In Bessemer circles a good deal of feeling has been excited by the giving of an order for 10,000 steel sleepers by the Midland Railway Company to the John Cockerill Company, of Seraing, Belgium. It may be that this is the coming cross-tie.

The New K. C. B. R.—A large meeting was held at the Board of Trade Hall, Kansas City, November 5, for the discussion of the railroad to be built from that city into Nebraska. It was decided to change the name to the Kansas City, Wyandotte, Nebraska and Northeastern, and the survey will be pushed to completion.

America in Brazil.—Brazilians say that, while they can buy iron cheaper in England than in the United States, they regard American engineering as the best. American bridges are lighter in weight, which makes up for the difference in price per pound. American locomotives they consider much better suited to their roads.

The Inter Ocean Improvement Company has been incorporated in this city, with a capital of $1,000,000, for the purpose of constructing and equipping elevated railways in Chicago. Its incorporators are Thomas Cochran, John J. Stadiger, Peter J. Claassen, Gerard Irving Whitehead, and V. E. Steiger.

Railroad Work at Wichita.—WICHITA, KAN., November 7th.—The contract has been let for the Wichita and Colorado Railroad, known as the "Eagle line," projected from this city northwest through Sedgwick, Reno and Stafford counties, crossing the great Arkansas at or in the vicinity of Great Bend; thence westward to the coal fields of eastern Colorado. Work will commence on the line west from this city next Monday. The first twenty-five miles will be in operation by the last of January.

Great Guns and Plate Armor.—WASHINGTON, Nov. 6.—Senators Hawley and Sewell, of the select committee on ordnance, were in the city to-day on business connected with the work of the committee. They have been at work for over a year, collecting information concerning the construction of steel guns and plate armor. Senator Hawley says that they have not quite completed their work of investigation, but they have collected much valuable information, both here and abroad, bearing on the subject, and they expect to make a report in December.

New R. R.—BUFFALO, Nov. 10.—A company has been formed in this city to build a railroad from Jamestown to a point of intersection with the Dunkirk, Alleghany Valley and Pittsburg, near Falconer. It is to form a part of a through line between Jamestown and Buffalo by the Lake Shore and Michigan Southern, with through car service for passengers and freight. The road is to be completed on June 1, 1886, and work will be begun at once. The following officers were elected: President, C. A. Clute, Fredonia; Vice-President, J. A. Burch, Buffalo; Secretary, O. W. Gawne, Fredonia; Executive Committee, C. A. Clute, J. A. Burch, S. B. Broadhead and J. K. Patterson.

The Lachine Bridge.—The contract for the superstructure of the Canadian Pacific Railway Company's bridge at Lachine has been awarded to the Dominion Bridge Company. The whole cost of the work will be, it appears, within the estimate of $1,250,000 made by Mr. Peterson, the engineer-in-chief of the company, and is about equally divided between iron and steel work. The bridge, which has been planned by Mr. Peterson, will consist of two spans of 269 feet each, two of 408 feet each, the channel spans, and eight of 242 feet. It will be a simple iron girder truss bridge, the track running on the top of the truss, excepting for the channel spans, where the girder rises. The contract of Messrs. Reid & Fleming requires that the stone work should be completed by November 30, 1886, and they have already commenced operations and are getting out stone at Terrebonne.

Indianapolis and Evansville.—INDIANAPOLIS, IND., November 8.—An addition to the numerous companies organized to build a railroad between Indianapolis and Evansville has been incorporated. It is the result of consolidation, the parties being the Indianapolis and Evansville Railroad Company, operating a line between Evansville and Maysville, and owning a partially completed line from Maysville to Worthington, and the Terre Haute and Southeastern Road, operating a road between Terre Haute and Worthington. The new organization is to be known as the Evansville and Indianapolis, and has a capital stock of only $2,000,000. The Directors are: Wm. Heitman, Edwin Taylor, Wm. D. Ewing, Samuel Archer, E. P. Hunter, D. J. Mackey and E. E. Law.

N. Y. & B. Inland.—BOSTON, Nov. 11.—The annual statement of the New York and Boston Inland, the road which is designed to shorten the time between New York and Boston to four hours, shows that the authorized capital is $500,000, of which $37,200 has been paid on 372 shares and $90,520 on 4,628 shares, making the total amount paid in $127,720. There has been expended for grading and measuring $42,000; superstructure, $10,694; land damages etc., $35,222; engineering, agency, salaries, etc., $95,260; total, $145,375. The treasury contains in cash $91.51. The report states that the company has organized and obtained certificates of incorporation dated January 17, 1885, and has also filed with the Secretary of State certificates dated January 14, 1885, that the law has been complied with.

Inspection of the Tay Bridge.—Sir James Falshaw chairman of the North British Railway Company, and Mr. Carswell, engineer to the company, made an inspection of the Tay Bridge works, October 17th. On their arrival at Dundee they were met by Mr. Arrol, the contractor, in one of whose steam launches they were taken out to the works in the middle of the river. The visit lasted several hours, Sir James and Mr. Carswell making a very minute examination of the whole of the operations. The sinking of the piers, the most difficult and tedious part of the undertaking, is now within measurable distance of completion, and at the present rate of progress the whole of the cylinders will be sunk in the course of six or seven months, unless the weather during the winter and spring should prove exceptionally severe. Ten pairs of cylinders in the center of the river have to be sunk and two at the north end of the gap. Two large pontoons are employed for the construction of the large piers, and a small pontoon, which has been undergoing an overhaul at the south side, is expected to be ready this week to begin the work of sinking the smaller piers at the north end of the gap.

The Palisade Construction Company has been incorporated by Appleton Morgan, George A. Lawrence, Edward Leavitt, Jr., James E. Reynolds, and George Livingston Baker, with a capital of $250,000, to build a railroad over the Palisades to connect Piermont and Jersey City.

Changing Gauge.—It is stated that the Texas and St. Louis Railroad will at once be changed from narrow to standard gauge. The company will also construct a line from near Brinkley, Ark., sixty miles west, to Memphis, Tenn.

Sale of a Railroad.—The Chicago and Western Dummy Railroad was sold November 9th, under foreclosure for $46,000. The road extends from the city limits to Oak Park. The statement is published that it was purchased in the interest of one of the railroad companies seeking an entrance into the city.

The California Southern's Last Spike.—The last spike on the California Southern Railroad was driven on the 9th at Cajon Pass. This gives the Atlantic and Pacific Railroad through connection to the Pacific coast, with San Diego as the terminus.

Repairs of Motive Power.—The average cost of repairs and renewals of locomotives on fourteen railroads in the United Kingdom was 7.8 per cent.; in the United States, on eight roads, the average was 5.7 per cent., notwithstanding wages here are 50 per cent. higher than abroad. The cost of motive power is nearly twice as great on the English as on the American roads.

Locomotive Engine Running and Management, by Angus Sinclair, gives full directions about handling and repairing locomotives; instructs how to design valve gear and set valves; Westinghouse air brake explained by aid of engravings. Price $2. For sale by ENGINEERING NEWS PUBLISHING COUNTY.

The Northern Pacific board, at the last meeting ordered the survey of a new line from the main line to Butte City, M. T. If this road is built, it will be upon the same terms that other branches have been constructed and leased, upon the actual cost per mile.

The Kansas & Colorado Railroad.—The directors of the Kansas & Colorado railway are preparing to go on with the construction of their road to the Southwest. It will be remembered that propositions in aid of this road have been carried in the counties of Saline, McPherson and Rice, and a similar proposition is now pending in Rush county, with the probability that it will be carried. In Barton county a proposition will be submitted next week.—*Saline County Journal.*

The Southern Pacific Company has just finished a substantial bridge across the Salinas river, Cal., between Castroville and Monterey. The structure is 510 feet long, and is built of three spans. All the approaches are built after the plan adopted for bridge-building over the Po, in Italy. Piles are driven five feet apart along the banks, and the intervening space is filled with willows. This arrangement, it is expected, will effectually prevent washouts during high water.

Railroad Building in the Northwest.—A prominent St. Paul railroad official, speaking of prospective railroad-building in the Northwest, said no one had any idea of the immense amount of work of this description which was proposed for the near future. Profiles have been drawn and specifications made for upwards of 5,000 miles. Most of this, it is said, will be built next year, and if money is at all free the spring of '86 will find thousands of men scattered throughout the Northwest making surveys, moving dirt, and laying track. The building of the immediate future will be confined mostly to the construction of branches for feeders to the existing roads.

An Ancient Tunnel.—The "Ear of Dionysius," in Sicily, is a long limestone tunnel with a wide mouth. It is about seventy feet high for a distance of about 200 yards, after which the roof descends. At the further extremity of the high arch, and about sixty feet from the floor, is a small concealed chamber excavated in the rock, in which, according to tradition, Dionysius sat to listen to the conversation of his prisoners below who whispered stealthily of their plots and other doings. It is a fact that sounds produced below are so reverberated that a slight whisper, if uttered near one of the walls, can be heard in this chamber at about 200 feet distance.

Canalization of the Moselle.—The Chambers of Commerce of Coblenz, Tours and Metz, among others, have continued to urge this undertaking. The Dortmund Association for the advancement of mining interest, go so far as to say that it is of absolutely vital importance for Rhenish-Westphalian industry. The estimated cost for making the river navigable for vessels of 500 tons from Metz to Coblenz is $3,750,000; but at $6,200,000, it is claimed that the enterprise would pay. One million tons of coke and the same amount of other traffic is expected, which will be taken from existing railroads; the tolls and charges on the basis of those on the Rhine and Ruhr, show a probable saving of 30 to 40 per cent. compared with the present railroad charges.—*Financial News*, Oct. 24.

New Bridge.—The Kentucky Central R. R. will soon build a bridge over the Ohio at Cincinnati; they have secured from the Common Council the right of way through necessary streets.

South Carolina R. R. Project.—There is on foot in Oconee county, S. C., a project for the building of a railroad, to be called the South Side railway, from the mountains through Oconee, Anderson, Abbeville, Edgefield, Aiken, and from the latter place by the shortest route to Charleston.

The Little Falls Accident.—The coroner's jury in the case of Mrs. Pratt, who was killed in the accident on the West Shore Railroad, near Little Falls, on the 9th, rendered a verdict, charging the railroad company with gross negligence is not having provided a culvert at the place of the accident to carry off the water in the time of a freshet, that place being a natural outlet.

Augusta & Chattanooga R. R.—Mr. J. W. Quintard, of New York, president of the Augusta and Chattanooga Air Line Railroad, was in Augusta, Ga., last week in conference with the directors of the road with a view to beginning work as soon as possible. The building of the road seems to be an assured fact.

Chesapeake & Nashville.—President Zimmerman states in interview that work between Gallatin and Nashville will be begun as soon as the committees of the Merchants Exchange of Nashville complete their work and the city makes deed to the Park. Steel rails for entire line have already been purchased, and bids are being received for cars and engines, also for cross-ties.

Cape Girardeau and Southwestern.—The Directors of the Texas Branch of the Cape Girardeau and Southwestern Railway met on the 1st, and elected W. Brown President, R. G. Raney, Vice President, Leon J. Albert, Treasurer, and T. F. Wheeler, Secretary. The arrangements are completed, and work will commence on the construction of the first section of the road within thirty days.

Canadian Pacific R. R.—WINNIPEG, MANITOBA, Nov. 8th.—The last spike of the Canadian Pacific Railway was driven near Farwell, British Columbia, at 9.22 Saturday morning, by the Hon. Donald Smith. General Manager Van Horne was present, and the party went through to the Pacific coast, thus traversing for the first time the whole line from ocean to ocean.

Railroad Building in Central Kansas.—Mr. E. H. Gibbs received a telegram from Col. Everest recently, repeating a telegram from Col. Hoxie, instructing the chief engineer to put a force on from Salina east; also instructing the contractor in Dickinson county when through there, to throw his entire force into Salina county. Also, that Mr. Gould intends to build into Salina at as early a date as possible.—*Salina Journal.*

Mt. Kearsarge R. R.—The directors of the North Conway and Mt. Kearsarge Railroad have set about raising funds to build two divisions of their railroad immediately before the summer traffic sets in for next season. These are the North Conway division of six miles to the common junction of the three divisions near Chatham Notch and the mountain division of nine miles from that junction to the summit of Mt. Kearsarge. The third division proposed is the Chatham division of 11 miles from the junction to North Chatham. The authorized capital is $400,000, in shares of $100 each, and the first mortgage bonds to the amount of $200,000. The issue of 1,500 preferred and 1,500 common shares, $300,000, for the first two divisions, has been made and the full paid proceeds have been expended for legal expenses, engineering, rights of way, property, work, etc., leaving a surplus in the treasury.

The Universal Gas Company, of New York, capital stock $2,500,000, filed articles of incorporation at Albany on the 5th.

The Transcontinental Association.—ST. LOUIS, Oct. 29th.—The Transcontinental Association have notified all their connecting lines that owing to the nature of grades, tunnels, snow-sheds, etc., the greatest dimensions box cars should have, in order to run safely west of the Missouri river, are as follows: Length, 35 feet; height, 12 feet and 6 inches from the level of the top of the rail to the eave or edge of the roof, on the side of the car; width, 10 feet, if the height is not more than 12 feet from the top of the rail. If the height is over 12 feet and not over 12 feet 6 inches from the top of the rail, the maximum width will be 9 feet 6 inches. Agricultural implements, wagons and similar freight, when loaded on flat cars, should not be loaded to exceed 11 feet 6 inches in the extreme height, above the top of the rail, or 9 feet in the extreme width, and should be well secured by iron rods passing over the load and connecting the upper ends of the stake in such a manner as to prevent them spreading. The companies reserve the right, when the above are not complied with, to refuse the freight, to transport it entirely at the owner's risk of injury from collision, from tunnels, water-tanks, snow-sheds, etc., or to remove any excess from the car, and charge first class rates on the same. Cars which exceed these dimensions in any particular will not be received by the lines west of the Missouri river, neither will they pay mileage for the use of cars exceeding 30 feet in length owned by individuals or corporations, other than regular transportation companies.

Work on the Reading & Pottsville R. R., near Hamburg, Pa.

The Reading & Pottsville R. R., is being built by the Pennsylvania R. R. Co., up the Schuylkill Valley from Reading to New Boston, a short distance north of Pottsville in the heart of the anthracite coal regions where it connects with the Lehigh Valley R. R. The R. & P. R. R. is an extension of the Penna. & Schuylkill Valley R. R., which has been in operation between Philadelphia and Reading since the middle of June 1884.

The road follows the east bank of the Schuylkill river to Hamburg, 17 miles north of Reading, where it crosses to the west bank, which it follows as far as Auburn, where it again crosses to the east side and follows it to New Boston. There is one tunnel, a 600 feet one, about one mile north of Pottsville. The work of constructing the road is being rapidly pushed forward, and it will be completed and trains running as far as Hamburg by the first of December. The contracts for constructing the road-bed are held as follows, taken in their order from Reading: Nolan & O'Reily, two miles; Kennedy Crossen, two miles; Nolan & O'Reily, five miles; Nolan Brothers, four miles; Keller & Bush, two miles; C. McFadden, seven miles; Keller & Riley, three miles; Drake, Stratton, & Co., two miles; and John T. Dyer, two miles.

The largest continuous contract on the road is that of Charles McFadden, which begins fifteen miles north of Reading, and extends to the north seven miles, including the piers and abutments for two iron bridges, one over the Schuylkill river, of five spans, and one, of three spans over the P. & R. track, also 1,200 feet of wooden trestel work.

Mr. McFadden employs on this contract about five hundred and eighty men, including fifty Italians and fifty Hungarians. Work is being carried on at three different places; at Hamburg, at the big cut and at Port Clinton.

At the big cut where the steam shovels, locomotives and cars are used, the work is carried on night and day, the work being done at night by the light from miners' torches and lanterns. The men are paid as follows: laborers, $1 to $1.25 per day; bosses, $3.00; masons, $2.50; blacksmiths, $2.25; and carpenters $2.25. There are two steam shovels at work in the cut at different levels. The top level is about 50 feet above grade, the second is 30 feet and the third is at grade. The shovels are started in on any one of the levels by making a level place in the side hill on the line for it to make a start in. Then a track is made by hooking together short pieces of pine beams with thick straps of iron bolted on top for the wheels to run on. The track is made in short sections so that it can be laid down only as fast as it is needed. Along side of the track for the shovel is laid a track for the dump cars. This track is kept even with the other, and the cars are run in on it so that when the crane with the shovel bucket swings around at right angles to the track, the bucket will hang over the car. In good shoveling, two buckets full will fill a car which is made to carry two cubic yards.

The earth is loosened up for the shovel by blasting. This is done whether there is any rock in the cut or not. After the holes have been "squibbed", the blasting powder is poured in, 250 pounds for a blast on the upper lift, which is 16 feet deep, and 900 to 1,000 pounds for the lower lift, which is 30 feet deep; fine gravel is tamped down on top of it, and the whole discharged by electricity. A single blast on the upper lift loosens up about 300 yards of earth and one on the lower lift about 3,000 yards. Each one of these shovels can move about 600 cubic yards of earth per day of eleven hours. Three men are necessary to manage the shovel, engineer, fireman and craneman, but from eight to ten more are at work hauling away full cars and bringing in the empty ones, breaking up large stones, loosening up the earth and stones in the bottom of the excavation where the big blast did not do it, etc. At present one shovel is at work on the upper lift and the other on the lower one, but when the upper lift is finished that shovel will be started in at the other end of the cut and they will try to take the whole 50 or 55 feet at once. This can be done if they don't encounter too many rocks. At present the work is mostly in loose red shale, but there is one stratum of blue rock about 15 feet thick, which crosses the cut about half way down at an angle of about 45° with the level of the grade.

The steam shovels are the "Otis Excavators" made by John Souther & Co. of Boston, Mass. The boilers are 15 H. P., but the engine and gearing are 25 H. P. They each use half a ton of coal per day.

Contracting.

New Bridge.—The matter of a bridge across the Ocklawaha, at Tavares, Fla., is awaiting a contractor's bid.

Court House.—The contracts for the Kinsley, Kan., Court House are to be let December 5th, the work to be finished May 1st, 1886.

Coney Island Street Contract Awarded.—The Grading and Opening Commissioners of West Eighth street, Coney Island, have awarded the contract to John Curran, of Brooklyn, for the sum of $13,834.60.

Bids on the Harford Run Sewer, Opened at Baltimore, Md., October 19, 1885.

This sewer, known as the "Southern Extension," will be about 6,900 feet long. It is 17 feet span with a rise of 8 feet 6 inches for 1000 feet; the remainder is circular, 10 feet inside diameter. The contract was awarded to Jones & Thorne, on October 21st. $350,000 was appropriated for this sewer work; C. A. Hook is the engineer-in-charge.

APPROXIMATE QUANTITIES.	20,000	100	100	25	25	10,484	2,010	1,030	1,400	273	9,549	7,680	200	92,400	925,880	1,000	20,1	36,000	
BIDDERS.	Earth Excavation per cu. yd.	Solid Rock per cu. yd.	Loose Rock per cu. yd.	Dressed Ashlar Masonry per cu. yd.	Rock Ashlar Masonry per cu. yd.	No. 1 Rubble Masonry per cu. yd.	No. 2 Rubble Masonry per cu. yd.	Skew Back Masonry per cu. yd.	Stone Pavements per cu. yd.	Concrete Masonry per cu. yd.	Brick Masonry per cu. yd.	Drifting per cu. yd.	Shafting per cu. yd.	Piles per lineal ft.	Lumber per ft. B. M.	Flagging per sq. ft.	Man Hole Castings per lb.	Cast-Iron Pipes per lb.	Totals.
	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.
W. B. Brooks, Jr	40	1.50	.90	21.00	14.50	6.90	5.80	25.00	12.25	6.50	8.50	4.75	6 00	15¾	30,00	.90	05	05	302,122.50
Morris, Murphy & Co	38	1.25	1.00	24.00	19.00	5.55	4.37	9.00	7.90	5.55	8.31	2.95	4.00	19	28.00	.80	02¾	02½	246,292.88
H. L. Cranford & Kirby	40	1.50	1.00	25.00	20.00	5.60	4.70	10.00	8.00	6.00	8.33	3.03	5.00	20	30.00	.80	03	03	253,031.97
J. B. Bates	30	.50	.30	20.00	12.00	4.40	4.00	15.00	10.50	5.00	8.00	2.40	3.00	18	30.00	.80	03	03	234,919.00
R. A. Malone & Sons	30	2.00	1.00	30.00	20.00	5.50	4.50	20.00	7.00	5.00	8.50	3.50	5.00	22	24.00	1.00	02	02	259,709.62
Chas. Ogle	40	4.00	1.50	10.00	4.00	5.75	4.75	6.00	2.50	8.00	7.50	3.30	1.50	20	27.00	.20	04	03	233,253.76
Wm. R. Weaver	22	1.00	.70	18.00	9.00	5.25	3.25	12.00	7.50	3.50	7.25	2.65	4.00	15	27.00	.35	02½	01½	221,102.01
L. B. McCabe & Bro	60	1.25	.60	25.00	15.90	4.75	4.50	12.00	8.00	5.00	8.00	2.25	7.00	24	32.00	1.00	05	05	247,682.16
Hugh Gracey	25	.50	.40	15.00	13.00	3.75	3.75	17.95	8.95	4.95	7.90	2.20	2.95	14	27.50	.75	03	03	218,802.65
Jones & Thorne	24	.80	.40	15.00	12.00	4.00	3.50	14.00	6.00	4.00	7.75	2.20	4.00	18	27.00	.30	03½	03	213,930.51
Owen Patterson	20	.25	.50	15.00	12.00	5.00	4.00	16.50	11.75	5.00	7.95	2.40	5.00	22½	25.00	1.25	02	02	241,706.55
Lyons & Holland	28	.75	.65	17.00	15.00	4.00	3.98	19.00	8.98	4.98	7.95	2.25	3.25	18	29.90	.85	03	03	230,709.60
Heffner, Knapman & Co	29	.90	.45	14.75	10.00	4.97	3.50	13.62	6.50	4.85	7.20	2.55	3.75	19	27.00	.70	03	03	224,207.44

The Chicago & Gulf Equipment Company has been incorporated at Chicago; capital stock, $500,000; to deal in rolling-stock for railroads; incorporators, F. B. Dyche, H. J. Messing, W. B. Woodman and P. W. Drew.

Preparing to Complete the Canal.—The Dominion government will this week call for tenders for deepening the Welland canal to fourteen feet, so that vessels of that draught may pass down the St. Lawrence without lightering. The cost will be about $1,500,000.

The Keithsburg, Ill., Bridge.—While hoisting a heavy member of this bridge, on November 9, one of the corner posts of the traveller gave way, and falling, carried with it the false works of that span. One man was killed and several badly hurt.

The Nashville Bridge.—On November 2, the false works of this bridge were carried away by drift-wood brought down in a heavy rise in the river. The timber work is entirely wrecked, but as the erection of iron was to commence on November 3, the loss is confined to the false works only.

Annual Report of the A. T. & S. F. R. R.—There are in Colorado seven wooden truss bridges, one combination bridge, three iron bridges, one iron trestle and 424 wooden trestle and pile bridges, and two box culverts of timber and stone. During the year there were 66,472 new ties laid and 2,004 tons of steel rail laid. The road has five crossings in Colorado. There are forty-six track miles of fence in the State, which cost $45 176.

A New Hotel for Philadelphia.—A project is on foot looking toward a new hotel in Philadelphia, to be built on a large scale. Theodore Walton, who in the past has had considerable hotel experience, is in the city in the interest of New York parties, and has had interviews with a number of Philadelphia capitalists, with a view to the formation of a company to carry out the enterprise. The intention is to locate the hotel in the vicinity of Broad and Walnut streets.

A Compromise Rejected.—MEMPHIS, Tenn., Nov. 8th.—The proposition of T. E. Brown, the Nicholson pavement contractor, who holds $300,000 of old city indebtedness, to settle it for $275,000, in new 6 per cent bonds, was rejected by the Auditing Board yesterday. The case is in the United States Supreme Court, and will be reached in two years. It was chiefly on account of the Brown mandamus that Memphis relinquished her charter and became the first taxing district in the United States. All debts except that to Brown have been settled.

A Breakwater to Cost $40,000,000.—PANAMA, Oct. 24th.—Great improvements are being effected in Venezuela. The work of building a breakwater at Laguayra on the coast, a few miles from Caracas, is to be begun at once. The entire breakwater will cost $40,000,000. Blocks of concrete weighing 500 tons each will be laid in the sea. No money will be taken from the public treasury. The London company agrees to accept a certain sum per package for all merchandise going over the breakwater for ninety-nine years.

Bids for Building the New Town House.—The selectmen have opened the bids on "specifications number 2" for building the new town house, Hartford, Conn. These bids are simply for the work on the main building and are as follows:

Carpenter work:

Barrett Bros	$21,740
H. B. Philbrick	22,000
George Kibbe	20,742
D. C. Cornish	20,625
Watson H. Bliss	20,450

Mason work.—

Tryon & Dimond	$37,587
Angus & Dallas	37,542
Sylvester Bissell	33,447
James Spellacy	34,350

The carpenter work was awarded to Watson H. Bliss and the mason work to Sylvester Bissell. The bids for plumbing and steam heating were laid upon the table for future action.

Bids on the "Northern Extension" Sewer, at Baltimore, Md.

The bids given below were opened on October 19th. This sewer will be 3000 feet long: circular in shape and 8 feet inside diameter. Messrs. Jones and Thorne were awarded the contract on October 21st.

APPROXIMATE QUANTITIES.	18,000	3,834	380	2,236	10,000	400	10,000	5,000	
BIDDERS.	Earth Excavation per cu. yd.	Rubble Masonry per cu. yd.	Stone Pavement per cu. yd.	Brick Masonry per cu. yd.	Lumber per ft. B. M.	Flagging per sq. ft.	Man Hole Castings per lb.	Cast Iron Pipe per lb.	Totals.
	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.
Walter B. Brooks, Jr	30	5.50	12.25	8.50	31.00	.90	05	05	52,078.80
Morris, Murphy & Co	30	4.37	7.75	7.75	23.00	.75	02¾	02½	43,823.58
H. L. Cranford & Kirby	37	4.54	8.00	7.80	25.00	.80	04	03	46,035.16
J. B. Bates	20	3.75	10.50	7.50	22.06	.80	03	03	40,177.50
R. A. Malone & Sons	30	4.50	7.00	8.50	24.00	1.00	02	02	45,769.00
Harding, Young & Co	25	4.37	6.50	7 80	27.00	.80	04	02½	42,635.88
Chas. Ogle	33	4.25	2.50	7.25	27.00	.20	04	03	40,630.50
Wm. R. Weaver	33	3.25	7.50	7.25	27.00	.35	02½	01½	38,631.50
L. B. McCabe & Bro	50	4.50	8.00	8.00	32.00	1.00	05	05	49,131.00
P. Reddington & McGovern	30	4.25	9.25	8.00	20.00	1.10	04	02	44,617.50
Hugh Gracey	21	3.65	8.00	7.95	16.50	.80	03	03	40,072.30
Jones & Thorne	20	3.50	6.00	7.70	27.00	.30	03½	03	37,868.20
Owen Patterson	18	3.40	11.75	7.85	20 00	1.25	02	01½	39,739.20
Lyons & Holland	22	3.75	9.00	8.00	17.00	.85	04	04	41,085.50
Heffner, Knapman & Co	25	3.50	6.00	7.20	28.00	70	04	03	37,720.20

The Cincinnati Board of Public Works are on an extended tour of inspection of asphalt pavements in a number of cities where it has been in use. They have visited Cleveland, Buffalo, Rochester, New York, Philadelphia and other points.

A Costly Work Ruined.—MEMPHIS, TENN., Nov. 6th.—Only about 10 feet of the retaining wall on the west side of Custom House bluff, put up by the United States, now remains standing, all of it having been thrown over by the action of the heavy rains. The finishing touches would have been placed on it in about thirty days. The cost was about $40,000, but it was said to be too weak, being only three feet at the base when it should have been five. It was of solid masonry laid in cement.

Brick Work.—The following is a synopsis of bids for brick work for basement and area walls of the court house, etc., at Louisville, Ky., received under advertisement dated September 7, 1885:—E. F. Gobel, Indianapolis, Ind., $1",966.40; Geo. Hoertz, Louisville, Ky. $14,095; John Bornhauser & Co., Louisville, Ky., $14,500; Belknap & Dumesnil Stone Company, Louisville, Ky., $15,100; Fred. Hoertz, Louisville, Ky., $16,800; M. A. McGowan, Washington, $17,093; John Moore, Syracuse, N. Y. $22,250; Justin McCarthy & Co., Washington, $22,518. The lowest bid has been accepted.

A Sunken Steamer Raised.—The Canadian steamer "Quebec," which sank in 134 feet of water in Sault River, near the outlet of Lake Superior, has finally been raised to the surface. The raising of the "Quebec" is a notable triumph in marine wrecking, though the contractor who undertook the work is practically bankrupt by the job. No vessel has ever been raised from such a depth in the Lakes before. Three times the wreck was brought to the surface, and three times the chains broke and it went to the bottom again. The loss amounts to about $50,000.—*N. Y. Times.*

Steam Heating Contracts.—The proposals for supplying and putting in place complete low-pressure, gravity steam heating apparatus for the new school houses in process of construction, at Worcester, Mass., were as follows:—

Milbury Street—Braman, Dow & Co., $1,237; Pierce, Butler & Pierce, of Syracuse, N. Y., $1,393; Washburn & Garfield, $1,535; O. S. Kendall & Co., $1,834.

Sunnyside—Braman, Dow, & Co., $1,253; Pierce, Butler & Pierce, $1,379; Washburn & Garfield, $1,535; O. S. Kendall & Co., $1,835.

Freeland Street—Pierce, Butler & Pierce, $2,387; Braman, Dow & Co., $2,783; O. S. Kendall & Co., $2,889; Washburn & Garfield, $2,934.

The contract in each case was awarded to the lowest bidder.

College.—Work will commence on the new Presbyterian College at Wichita, Kan., at once, the contract having been let for a $5,000 building.

Iron Roof, etc.—The following is a synopsis of bids for iron roof, ceiling beams, cornices, etc., of the post office, etc., at Syracuse, N. Y., received under advertisement dated October 10, 1885: Phœnix Iron Company, Trenton, N. J., $10,750; Haugh, Ketcham & Co., Indianapolis, Ind., $10,874.58; Snead & Co. Iron Works, Louisville, Ky., $11,549; Motherwell Iron and Stee Company, Logan, Ohio, $12,200. The lowest bid h been accepted.

Rock Island Extensions.—The Chicago, Rock Island & Pacific Railroad company has let the contract for building the Rushville extension of its road. Sheridan Bros., received the contracts for building the first five miles of the road, and Mr. J. D. McNeely was awarded the balance—ten miles. The grading is to be completed in four weeks time, and it is the intention of the company to have the line in operation by the 1st of January next. The track on the Winston & St. Joseph extension have been laid as far as Grindstone creek, eight miles west of Winston junction.

The Stanford University.—SAN FRANCISCO, Nov. 10.—The details of Senator Stanford's scheme for the establishment, in California, of a great university, were today made public for the first time. His range at Palo Alto, near Menlo Park, about thirty miles from San Francisco, has been selected as the site. The several buildings comprising the university will be on the general plan of a parallelogram, and will be constructed so as to permit additions being made as the necessities of the institution may require. Senator Stanford will give to the university his Palo Alto, Gridley, and Vina properties, worth $5,300,000. To this he will add a money donation, so as to make the total endowment of the university $20,000,000.

New Orleans Advertising for Bids.—In conformity with motions adopted at last Council meeting, the Comptroller has advertised for bids for repairing Valence street, repairing No. 7's engine house, building iron bridges over the Old Basin at Esplanade, Broad, Galvez, Villere and Marais streets; over the New Basin at Liberty street, and wooden bridges over Claiborne canal at Josephine and Second streets.

The advertisement for bids for the iron bridges is one of great importance, as at present it is impossible to cross any of the canals owing to the dilapidated condition of the bridges now in use. Councilman Mauberrett, who is the father of the motion to advertise for bids, is determined to have the bridges constructed, and will advocate the measure with all his ability.—*Times-Democrat.*

Covington & Macon R. R.—B. W. Frobel, chief engineer of the Covington and Macon Railroad, thinks work will be commenced at the Macon end of the road at an early day. An iron bridge will be built across the Ocmulgee river at Macon.

A Northern Pacific Branch.—The building of a branch by the Northern Pacific Railroad to a connection with an extension of the Palouse branch of the Oregon Railway and Navigation Company has been planned for a long time. President Harris, of the Northern Pacific, said that it had been under consideration since 1880. He said that the company would soon build a branch to Farmington, whether the Oregon Co. extended its line or not. Surveying parties had been sent out recently to select a route. President Smith, of the Oregon Railway and Navigation Company, said that he was in favor of building the Farmington branch, but did not know when the work of construction would be begun.—*N. Y. Tribune.*

Railroad Concessions.—Two railroad concessions have been granted by the government of the Argentine Republic to citizens of the United States, and they contemplate the most important lines in that country. One concession is held by Honoré & Bowen, of Chicago, and the other by a New York corporation, known as the "United States and South American Financial and Construction Company," of which Judge J. C. B. Drew, formerly of Florida, is the President, and Russell B. Pealer the Manager in South America. Mr. Honoré is a well known citizen of Chicago, who was formerly engaged in large real estate enterprises in that city, and is the father-in-law of Potter Palmer and Col. Fred. Grant. Mr. Bowen is a member of the equally well known Bowen family, of South Chicago fame.—*Railway Age.*

[We have frequently been written to for the address of "Bowen & Honoré" above referred to. H. H. Honoré is as well known in Chicago as any man well can be, and letters addressed to him there will always reach him. There were three Bowen brothers: Chauncey, James and George. The last named never had any interest in the South Chicago speculation; James was the enthusiast on that subject and was run over and killed on a railroad crossing at South Chicago; Chauncey has lived mostly in New York since a little complication about some South Park bonds in Chicago occurred. If these parties are the owners of the concession above referred to, they will probably make some money for Honoré & Bowen. Responsible contractors, however, will do well to investigate the Chicago record of the concessionaires before going further.—ED. ENG. NEWS.]

Bridges.—The Board of County Commissioners of Arapahoe County, Col., will receive sealed proposals until 10 o'clock a. m., November 25th, 1885, for the furnishing of material and the construction and erection of the following bridges, to-wit:

Bridge No. 1—Across the High Line Canal on the County road, located on the line between Sections 14 and 15, Township 4, south of range 67 west.

Bridge No. 2—Across the High Line Canal on the extension of Broadway at a point 170 feet south of the quarter corner on the north line of Section 27, Township 5, south of range 68 west.

Bridge No. 3—Across the High Line Canal on the extension of Broadway, at a point 1,604 feet south of the quarter corner on the north line of Section 27, Township 5, south of range 68, west.

Bridge No. 4—Across the gully on the extension of Broadway at a point 724 feet south of the quarter corner on the north line of Section 27, Township 5, south of range 68 west.

In accordance with the plans and specifications therefor now on file in the office of the Clerk of said Board, bidders must state the price for each bridge separately, and also the price for the whole work.

Proposals to be addressed to the County Clerk and endorsed "Proposals for Bridges." The Board reserves the right to reject any or all bids.

By order of the Board of County Commissioners, Denver, Col., November 4, 1885.

CHARLES H. SCOTT, County Clerk.

Wages in the Old World.—Wages in France are somewhat higher than in Germany. The customary rates in Alsace are greater than in any other portion of the German empire—*e. g.*, in Strassburg, carpenters receive $4.75 per week and laborers $4.21.

The lowest rates in Germany are found in Silesia, the average weekly wages of unskilled laborers being but $1.48, while in Prussia they are $2.19 and in the empire, as a whole, $2.40.

Wages in Italy are still lower than in Germany. The result is that large gangs of Italian laborers are brought into Germany when railroads or other extensive works are to be constructed

In Austria the wages of the spinners in the week of seventy-two hours, the woman's average being but $1.40, or less than 2 cents an hour.

The railway mechanics of Vienna, including the highest and best paid classes of skilled laborers, receive an average weekly wage of but $5.44.

In London household wages by the year average as follows: Plain cooks, $97.73; housekeepers, $146; waitresses and nursemaids, $82.73; barmaids, $97.33; butlers, $195; coachmen, $170.32.

Policemen and letter carriers in London are paid from $300 to $375 a year, while in the larger cities in this country they receive twice or three times as much.

In southern China mechanics receive from $4.50 to $8 a month; employes in shops and stores from $1.50 to $5.50; cooks and housemaids employed by foreigners, from $7 to $10, while servants and country land laborers are paid about $1.50 per month, with their food, which is worth as much more.

Recent Patents.

Apparatus for Dredging.—*Gardner F. Badger, Brooklyn, N. Y.* Pumps fitted with flexible attachments are hung from a framework on the barge and discharge the material brought up by suction into a hopper. No. 329,428.

Bridge.—*Emmerich A. Werner, New York, N. Y.* Two struts rest on the abutments and unite at their upper ends. Two ordinary girders form the bridge, their outer ends being held up by a rod attached to the upper end of the struts. No. 329, 249.

Gas Conduit.—*James I. Kay, Allegheny, Pa.* The joints of the underground conduit are fitted with leak chambers, from which pipes are led to a ventilating post above ground. No. 329,568.

Hoisting, Carrying and Delivering Apparatus.—*Wm. A. Fry, Washington, D. C.* A frame running on a railroad has an engine and a derrick from which track, hoisting and traversing ropes are run over the excavation and carry the buckets. No. 329,546.

Railroad Tie and Chair.—*Petherick Davey, Philadelphia, Pa.* Cross ties of shallow channel section have lugs and cheeks on the upper surface, forming a chair to which the rail is secured by keys. No. 329,821.

Railway.—*George E. Baldwin, Philadelphia, Pa.* A rail of T-section is supported in chairs, the web of the rail fitting into a groove in said chair. The chairs are placed at intervals and are connected transversely by gauge rods. No. 329,429.

Street Curb and Gutter.—*George D. Sutton, New York N. Y.* Different forms of hollow curbs with gutters combined. Shelves or ledges are fitted to support electric cables, pipes etc. Nos. 329, 342; 329, 343; 329, 344.

Market Report of Engineering Materials.

New York, November 12, 1885.

NOTE.—The following Market Report gives wholesale prices on the New York Market unless otherwise stated. It is intended as a general guide to the estimating engineer, and both the range of material and the market location will be extended as rapidly as possible. We give it with this caution, that, as is well understood in business transactions, the amount of bill, distance from market centre and conditions of payment will have a material influence on the final paying prices.

IRON.

STRUCTURAL IRON.		
Angles	1.95 @	2.05
Tee	2.2 @	2.4c.
Beams and channels American	3.0c. @	
Tank	2. @	2.1c
Shell	2.4c. @	2.5c
Steel plates, Tank	2¾c. @	3c.
WROUGHT-IRON PIPE., PITTSBURGH.		
Butt welded, black.....Discount	42½ @	45
" galvanized..... "	32½ @	35
Lap welded black..... "	60 @	62½
" Galvanized..... "	45 @	42½
Boiler tubes	57½	
RAILS.		
Steel (large lots at mill)	30.00 @	31.00
Old rails	17.25 @	17.50
Old railsteel	17.00 @	18.00
R R. spikes	1.8 @	1.9
R R. splice-plates	1.65 @	1.7.
R R. Track Bolts Square Nuts	2.55 @	2.65
Barb-wire fencing, galvanized		4.50
" " painted		3.50
Corrugated iron		
Nails		
Iron, per keg	3.25	
Steel do.	3.35	

METALS.

COPPER.		
Lake Superior	11 @	11¼
Other Brands	10 @	10½
LEAD.		
Com. Domestic	4.15	
Lead Pipe	.06¾	
Tin-Lined Lead Pipe	.15	
Sheet Lead	.06¾	
ZINC.		
Sheet	5.75 @	6.00

BRICK.

(Cargoes afloat)		
Haverstraw.....per M.	$5.75 @	6.12½
Fishkill		
Up-River	5.50 @	6.00
Jerseys	4.75 @	5.75
Long Island		
" pale	3.00 @	3.50
FRONTS.		
Croton red	11.00 @	14.00
" dark	11.00 @	14.00
" brown	10.00 @	13.00
Philadelphia pressed	24.00 @	25.00
Trenton "	24.00 @	25.00
Baltimore "	37.00 @	41.00
Buff "	33.00 @	35.00
Enameled English	65.00 @	130.00
" American	85.00 @	120.00
Fire brick	25.00 @	40.00

CEMENT.

The following price current is made up entirely from quotations furnished us directly by the firms dealing in each brand; the prices are understood to be wholesale in New York, subject to such special rates as large quantities may warrant:

BAETJER & MEYERSTEIN:		
Hanover Port.and	$2.60 @	$2.65
BELLONI & Co.:		
Hemmoor "Crown" brand		2.50
JAMES BRAND:		
K. B. & S	2.55 @	3.00
BROOKS, SHOOBRIDGE & Co.	2.55 @	2.60
HOWARD FLEMING:		
Gibbs' English Portland, 400 lbs	2.65 @	2.90
" K. B. & S. "	2.75 @	2.95
Stettiner, German	2.65 @	2.85
Lagerdorfer, "	2.45 @	2.75
Fieve, A 1, Belgian	2.35 @	2.50
Roman	2.75 @	3.00
Keene's Coarse	4.75 @	5.50
" Fine	7.75 @	8.50
" Superfine	8.50 @	10.00
GABRIEL & SCHALL:		
Vorwohler "Lion"	2.65 @	3.10
HUDSON RIVER CEMENT Co. Rosendale		1.10
JOHNSON & WILSON:		
Saylor's American Portland	2.15 @	2.40
LAWRENCE CEMENT Co.:		
Hoffman Rosendale		
LESLEY & TEINKLE, Philadelphia, Pa.:		
"Giant" Portland	2.20 @	2.40
Improved "Union"	1.25 @	1.50
Union	1.10 @	1.20
MARCIAL & Co.:		
J. B. White & Bros. Coarse	4.50 @	5.00
" " Fine	8.00 @	10.00
" " Portland	2.45 @	2.85
NEW YORK CEMENT Co.:		
Rosendale		1.20
N. Y. & ROSENDALE CEMENT Co.:		
Rosendale, "Bridge" brand		1.00
SINCLAIR & BABSON:		
Alsen's Portland	2.45 @	2.75
STANDARD CEMENT Co,		
E. THIELE:		
Dyckerhoff	2.90 @	3.25
UNITED STATES CEMENT Co.:		
Windsor	1.00 @	1.10
Standard		1.15
Cable's Portland	2.15 @	2.40
UNION AKRON CEMENT Co.:		
Akron "Star" brand.		

ASPHALT.

Prices range per ton	$15.00 @ 20.00
According to quantity or brand, and whether taken from vessel or store.	

LIME.

Rockland common per bbl	1.00
" finishing	1.20
State, common	.90
" finishing	1.10
Kingston, ground	0.95
Add 25c. to above figures for yard rates.	

STONE.

Cargo rates at New York.

Amherst freestone, No. 1 per cub. ft.	0.90 @	95
" " No. 2 "	0.75 @	0.80
" " light drab "	0.80 @	0.95
Berlin " in rough "	0.75 @	1.00
Berea " " "	0.75 @	1.00
Brownstone, Portland, Ct. "	1.00 @	1.30
" Belleville, N. J. "	0.75 @	1.25
Granite, rough	0.60 @	1.25
Common building stone per load	2.00 @	3.00
Base stone, from 2¼ to 6 ft. lengths, per lin. ft.	0.40 @	3.00

SLATE.

Purple roofing per square	6.00 @	7.00
Green "	6.00 @	7.00
Red "	15.00	
Black Penna. (at New York) "	4.50 @	5.00

LUMBER.

Prices for yard delivery in New York.

PINE, Common box per M.	18.00 @	20.0
" Choice "	55.00 @	80.
Tally plank, 1¼ in. 10 in. dres'd, each.	.44 @	.50
Tally boards, dressed com. "	.28 @	.30
SPRUCE, Boards dressed "	.25 @	.28
Plank, 1¼ in "	.28 @	.30
" 2 in. "	.38 @	.40
" 2 in. dressed "	.43 @	.45
Timber per M.	20.00 @	22.00
HEMLOCK, Boards each.	.18 @	.20
Joist, 2¼ × 4 to 4 × 6 in	.17 @	.44
OAK per M.	55.00 @	65.00
CYPRESS 1, 1¼, 2 and 2½ in "	35.00 @	40.00
YELLOW PINE, Girders "	25.00 @	30.00
Dressed flooring "	28.00 @	35.00
SHINGLES, Extra shaved pine, 16in. "		
" " sawed 18 in. "	5.75 @	6.00
LATH, Cargo rate "	2.10 @	2.25

PAINT.

Lead, white, American dry per lb	.04¾ @	.08
" " in oil pure "	.05½ @	.05¾
English, B. B. in oil	.08¾ @	.08¾
Red, American	.05¼ @	.05½
Litharge "	.05 @	.05¼
Venetian red, American "	.01 @	.01¼
Indian red "	.05 @	.10
Vermillion, American lead "	.11 @	.11½
Paris green "	.15 @	.19
Umber, Amer. raw and powdered per lb.	.01¼ @	.01½
Drop black, Amer.	.08 @	.12
" " "	.09 @	.11½
Chrome green	.05 @	.15
Oxide zinc, American	.03¾ @	.04
" French	.06¼ @	.06½